SELECTED

SWATERRESOURCES ABSTRACTS



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SELECTED WATER RESOURCES ABSTRACTS

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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1985.

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PREFACE

elected Water Resources Abstracts, a monthly S elected Water resources abstracts of current and earlier journal, includes abstracts of current and earlier reports and pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the Water Resources Thesaurus. The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific Information Center U.S. Geological Survey MS 425 National Center Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes: Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

0 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

TRANSPORT PHENOMENA. - NEW EXPERIMENTAL RESULTS IN HYDRODYNAMICAL FORCED RAYLEIGH SCATTERING' (PHENO-MENES DE TRANSPORT. - NOUVEAUX RE-SULTATS EXPERIMENTAUX EN DIFFUSION 'RAYLEIGH FORCEE' HYDRODYNAMIC),

Central Lab. of Mekorot (Israel).

Comptes Rendus de L'Academie die Sciences, Serie II, Vol. 299, No. 8, p 391-394, 1984. 2 Fig, 5

Descriptors: *Hydrodynamics, *Heat transfer, *Rayleigh scattering, Turbulent flow, Mathematical equations, Diffraction.

Temporal decrease of intensity diffracted by a phase grating in a flowing liquid was studied for spatial periods in the viscoconvective range. Turbulent transfers cause a relaxation of the mode of thermal fluctuations, which is followed with a laser diffracted by the index grating. The temperature modulation causes a modulation of the refractive index. The intensity is proportional to the temperature fluctuation spectrum. The decrease of intensity is plotted for different Reynolds numbers that characterize the Plane Poiseuille flow used. The decrease of intensity obeys an exponential law. When the flow is laminar, the time constant is the same as without flow. The values of p (the period) are in the viscoconvective range and the smallest structures impose their characteristic time on the convective transport of heat. (Moore-IVI)

1B. Aqueous Solutions and Suspensions

KINETIC FACTORS OF CACO3-PRECIPITA-TION AND THE PARTITIONING OF 12C AND 13C. STUDIES AT THE WATERPALLS OF GU-TERSTEIN AND URACH (SCHWABISCHE ALB) (KINETISCHE FAKTOREN DER CACO3-ABSCHEIDUNG UND DER FRAKTIONIER-UNG VON 12C UND 13C. UNTERSUCHUNGEN AN DEN WASSERFALLEN VON GUTERSTEIN UND URACH (SCHWABISCHE ALB)), Gesteinen Luist (Gertmann E. P.) Sedimenton

Goettingen Univ. (Germany, F.R.). Sedimentpe-trographisches Inst.

trographiscnes inst.
J. Michaelis, E. Usdowski, and G. Menschel.
Zeitschrift für Wasser und Abwasser Forchung,
Vol. 17, No. 2, p 31-36, 1984. 8 Fig, 2 Tab, 22 Ref.

Descriptors: *Calcite, *Mineral springs, *Guterstein, *Urach, *West Germany, *Carbon radioisotopes, Bicarbonates, Carbon dioxide, Crystal growth, Degassing, Chemical kinetics, Wastewater

Measurements along the CaCO3-depositing spring of Guterstein demonstrate that calcite is not precipitated immediately from a Ca-bicarbonate solution. In a first step the solution degases CO2. This causes the supersaturation to increase until crystalization begins at a CO3(2) activity of about lization begins at a CO3(2-) activity of about 0.000001 and Delta G about 1 kcal/mole. Due to 0.000001 and Delta G about 1 keal/mole. Due to degassing and precipitation the delta C-13 values of the dissolved carbonate increase systematically. The precipitated calcite should differ from the dissolved carbonate by Delta C-13 = 2.3 0/00 if isotopic equilibrium is attained. But, partitioning of the carbon isotopes does not occur because the solid is precipitated rapidly from a highly supersaturated solution. At the nearty spring of Urach the critical a Co3(2-) activity and Delta G-values are attained as well. But in contrast to an earlier period calcite does not precipitate at present. This is due, most probably, to inhibitors from waste water deposited in the recharge area. The delta C-13 values of the earlier calcite indicate recrystallization and isotopic re-equilibration. (Author's abstract) isotopic re-W85-01662

SOLUBILITY OF ORGANIC MIXTURES IN

WATER, Syracuse Research Corp., NY. Life and Environ-mental Sciences Div. For primary bibliographic entry see Field 5B. W85-02109

EULERIAN-LAGRANGIAN SOLUTION OF THE CONVECTION-DISPERSION EQUATION IN NATURAL COORDINATES, Geological Survey, Menlo Park, CA. R. T. Cheng, V. Casulli, and S. N. Milford. Water Resources Research, Vol. 20, No, 7, p 944-952, July, 1984. 7 Fig, 22 Ref.

Descriptors: *Convection, *Dispersion, *Eulerian-Lagrangian Method, Mathematical models, Mathe-matical equations, Anisotropic dispersion, Solute

Numerical modeling of environmental fluid motions is beset by the conflicting advantages and disadvantages of the Lagrangian and Eulerian viewpoints. While the Lagrangian method follows the natural motions of the water mass, the Eulerian scheme has the major advantage of working in a fixed reference field. An algorithm is proposed for numerical solutions of the convection-disperison equations that combines the best properties of the Eulerian and Lagrangian methods. The Eulerian-Lagrangian method (ELM) uses the Lagrangian concept in an Eulerian computational grid system. The Lagrangian concept gives a clear description of the conservation principles, the Eulerian concept provides a convenient working frame. The values of the dependent variable off the grid are calculated by interpolation. When a linear interpolation is used, the method is a slight improvement over the upwind difference method. At this level of approximation both the ELM and the upwind difference method of the first provential times and the second-order Lagrangian polynomials difference method suffer from large numerical dis-persion. If second-order Lagrangian polynomials are used in the interpolation, the ELM is proven to be free of artificial numerical dispersion for the convection-dispersion equation. The concept of the ELM is extended for treatment of anisotropic dispersion in natural coordinates. The anisotropic properties of dispersion can be conveniently related to the properties of the flow field, the ELM is stable, accurate, and practical for use in the very long term simulation of transport processes in an environmental system. (Moore-IVI)

2. WATER CYCLE

2A. General

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE, Swedish Natural Science Research Council, Stockholm.

For primary bibliographic entry see Field 6A. W85-01704

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982, Geological Survey, Anchorage, AK. Water Rees Div.

sources LIV.
D. R. Kernodle, R. R. Squires, and J. M. Childers.
Available from OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4170, 1983. 24 p, 10 Fig, 6
Tab, 11 Ref.

Descriptors: *Surface water, Streamflow, Floods, Hydrology, *Water quality, *Benthic inverte-brates, *Togiak River basin, *Alaska, Bristol Bay, Maximum evident floods, Environmental indica-

Data collected during August and September 1980 and March 1982 describe hydrologic characteris-tics of the Togiak River and its tributaries. Surface waters are generally cold and clear, have signifi-cant wilderness recreation values, and provide out-standing almon habitat. Late sumer unit runoff ranged from 2.3 to 8.1 cubic feet per second per

square mile. Stream width increased with discharge from about 20 feet on the tributaries to more than 300 feet on the Togiak River near its mouth. Mean depth increased with discharge downstream direction from about 1 to more than 4 feet. Mean velocity ranged between 1 and 4 feet per second and bore little relation to discharge. Late winter unit discharge for sites having little or no upstream lake storage was about 0.5 cubic foot per second per square mile. For the remaining sites, values ranged from 0.8 to 1.4 cubic feet per second per square mile. Unit runoff of maximum evident floods ranged from 1.2 to 1.4 cubic feet per second per square mile. Field measurements of water temperature, dissolved oxygen, pH, alkalinity and specific conductance indicated that water quality seems much the same throughout the basin and is influenced by the major lakes. Benthic invertebrates indicate a reasonably diverse fauna with midge larvae representing the largest percentage of all organisms found at most sites. (USGS) W85-01777

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATER-SHEDS IN EASTERN KANSAS USING A RAIN-FALL-RUNOFF MODEL,

Geological Survey, Lawrence, KS. Water Resources Div.

Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4110, 1983. 22 p, 2 Fig. 5 Tab, 21 Ref.

Descriptors: Surface water, *Floods, *Small watersheds, *Rainfall-runoff relationships, Precipitation, *Frequency analysis, Streamflow, Gaging stations, Model studies, Annual floods, Antecedit moisture, Surface runoff, Precipitation excess, *Flood frequency, *Kansas, Rainfall-runoff models, Skewness.

The U.S. Geological Survey rainfall-runoff model was used to estimate model parameters for 13 small watersheds in eastern Kansas with drainage areas of less than 11 square miles. Model parameters and rainfall data from three long-term rainfall stations were used in the model to synthesize long-term records of simulated annual peak discharge, which were fitted to a log-Pearson Type III distribution. Final estimates of T-year floods, which were computed by combining weighted estimates of the synthesized and observed T-floods, represent the most reliable estimates based on observed and long-term synthesized records of peak discharges. (USGS) W85-01786 W85-01786

DROUGHT EFFECT ON HIGH-ALTITUDE FORESTS, RUAHINE RANGE, NORTH ISLAND, NEW ZEALAND,

Ministry of Works and Development, Napier (New Zealand). Water and Soil Div. P. J. Grant.

New Zealand Journal of Botany, Vol. 22, No. 1, p 15-27, 1984. 7 Fig, 1 Tab, 32 Ref.

Descriptors: *Drought, *Ruahine Range, *New Zealand, *Forests, Rainfall, Deer, Soil erosion, Timberline, Temperature, Tree mortality, High al-

Shortly before 1917 abnormally high mortality of canopy trees occurred up to the timberline, c. 1470 m, in the central Ruahine Range. Rainfall records and historical observations indicate that this resulted from intense drought during 1914-15. Despite the drought damage and the impact of deer, the forest regenerated and after 1915 no major source area of coarse sediment developed in Centre Branch of the Waipawa Basin. Forest recovery at the head of the upper Waipawa Basin has produced a timberline which is c. 90 m lower than it was before 1915. On most of the Ruahine Range there is evidence of a recent lowering of timberline which probably also resulted from the 1914-15 drought and which is not associated with decrease of temperature. (Author's abstract)

Group 2A-General

EFFECTS OF CHANNEL EXCAVATION ON WATER-OUALITY CHARACTERISTICS OF EFFECIS OF CHANNEL EXCAVATION ON WATER-QUALITY CHARACTERISTICS OF THE BLACK RIVER AND ON GROUND-WATER LEVELS NEAR DUNN, NORTH CAROLINA, Geological Survey, Raleigh, NC. Water Resources Div.

C. E. Simmons, and S. A. Watkins. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 82-4083, 1982. 28 p, 15 Fig, 4 Tab, 9 Ref.

Descriptors: *Channel improvement, *Water quality, *Groundwater levels, *North Carolina, Chemical analyses, Bank storage, Suspended sediment, Nutrients, Dissolved solids, Streamflow characteristics, Black River, Channelized streams, Watertable wells, Mean concentrations, Channel alter-

ations.

During 1976-81 data were collected at three sites on the Black River near Dunn, N.C., to define the effects of channel excavation on stream quality and on ground-water levels in nearby areas. One of the data sites was located upstream from the five-mile long excavated reach and served as a background station. Changes in various characteristics of this Coastal Plain stream were determined by comparing data collected before, during, and after the construction period. After deepening of the channel by more than 2 feet, ground-water levels within 100 feet of the stream declined a proportionate amount; however, levels in a well 500 feet from the stream were unchanged. Flow velocities during channel deepening were 100 percent higher than velocities prior to construction. An average increase in water temperatures of about one degree Celsius was observed following removal of trees and brush that provided shading to the stream. After construction, concentrations of dissolved oxygen also increased. The percent of saturation increased 20 to 25 percent in the lower values. Maximum concentrations of suspended sediment increased from about 75 mg/L prior to construction to over 2000 mg/L during construction. Within a year after construction, levels of suspended sediment during stormflow had decreased but remained 5 to 10 times greater than preconstruction levels. Little or no change occurred in pH, total-dissolved solids, nitrogen, phosphorus, and bacteria. (USGS)

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS, Geological Survey, Lawrence, KS. Water Re-

sources Div. C. A. Perry, and R. J. Hart.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-403, 1984. 23 p, 8 Fig, 6 Tab, 22 Ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Frequency analysis, *Flood recurrence interval, *Urban runoff, Wichita, *Kansas, Gaged

A study of five basins within the city of Wichita, Kansas, describes the effects of varying degrees of urbanization on flood-frequency relationships. A rainfall-runoff model was calibrated for each basin with an average calibrated model error of 27.5 percent. The calibrated model synthesized 69 with an average calibrated model error of 27.5 percent. The calibrated model synthesized 69 water years of peak-discharge record for each basin. Log-Pearson Type III flood-frequency analyses were performed on each synthesized record. Flood frequencies for each basin also were computed using a short-term record of observed annual peak discharges, the modified Soil Conservation Service method, the Oklahoma method, and the National method. The preferred method for computing flood frequency is dependent on the recurrence interval needed and the quantity of available data. Evaluation of all methods revealed the necessity of including a basin area-channel length factor for urban basins. An analysis of the effects of increasing imperviousness on peak discharges indicated an average factor of 6.3 between the 2-year rural and urbanized flood and an average factor of

2.3 between the 100-year rural and urbanized flood. (USGS) W85-01949

BASIC CONCEPTS OF KINEMATIC-WAVE MODELS

Geological Survey, Lakewood, CO. Water Re-sources Div. J. E. Miller

Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Professional Paper 1302, 1984. 29 p, 10 Fig. 1 Tab, 39 Ref.

Descriptors: *Flow routing, *Kinematic wave models, Dynamic waves, Rivers, Watersheds, *Open channel flow, Unsteady flow, *Model stud-

The kinematic-wave model is one of a nur The kinematic-wave modes approximations of the dynamic-wave model. The dynamic-wave model describes one-dimensional shallow-water waves (unsteady, gradually varied, open-channel flow). The report provides a basic reference on the theory and application of kinemat-ic-wave models and describes the limitations of the model in relation to the other approximations of the dynamic-wave model. In the kinematic-wave approximation, a number of the terms in the equa-tion of motion are assumed to be insignificant. The approximation, a number of the terms in the equation of motion are assumed to be insignificant. The equation of motion is replaced by an equation describing uniform flow. Thus, the kinematic-wave model is described by the continuity equation and a uniform flow equation such as the well-known Chezy or Manning formulas. Kinematic-wave models are applicable to overland flow where lateral inflow is continuously added and is a large part of the total flow. For channel-routing applications, the kinematic-wave model always predicts a steeper wave with less dispersion and attenuation than actually occurs. The effect of the accumulation of errors in the kinematic-wave model shows that the approximations made in the development of the kinematic-wave equations are not generally justified for most channel-routing applications. Modified flow-routing models can be used which help to stop the accumulation of error that occurs when the kinematic-wave model is applied. (USGS) W85-02035

CALIBRATION AND VERIFICATION OF A CALIBRATION AND VERIFICATION OF A RAINFALL-RUNOFF MODEL AND A RUNOFF-QUALITY MODEL FOR SEVERAL URBAN BASINS IN THE DENVER METRO-POLITAN AREA, COLORADO, Geological Survey, Lakewood, CO. Water Resources Div.

sources Div.
J. B. Linder-Lunsford, and S. R. Ellis Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4286, 1984. 52 p, 6 Fig, 26 Tab, 7 Ref.

Descriptors: *Model studies, *Urban runoff, *Water quality, *Colorado, Denver, Jefferson County, Arapahoe County, Adams County, County, Araps Denver County.

Denver County.

The U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model-Version II was calibrated and verified for five urban basins in the Denver metropolitan area. Land-use types in the basins were light commerical, multifamily housing, single-family housing, and a shopping center. The overall accuracy of model predictions of peak flows and runoff volumes was about 15 percent for storms with rainfall intensities of less than 1 inch per hour and runoff volume of greater than 0.01 inch. Predictions generally were unsatisfactory for storm having a rainfall metasity of more than 1 inch per hour, or runoff of 0.01 inch or less. The Distributed Routing Rainfall-Runoff Model-Quality, a multievent runoff-quality model developed by the U.S. Geological Survey, was calibrated and verified on four basins. The model was found to be most useful in the prediction of seasonal loads of constituents in the runoff resulting from rainfall. The model was not very accurate in the prediction of runoff loads of individual constituents. (USGS) W85-02044

NASH MODEL RELATION TO HORTON ORDER RATIOS,

R. Rosso. Water Resources Research, Vol. 20, No. 7, p 914-920, July, 1984. 11 Fig, 3 Tab, 18 Ref.

Descriptors: *Hydrologic models, *Catchments, Model studies, Streamflow, Velocity, Rainfall-runoff relationships, Storms.

runoff relationships, Storms.

The Nash model of the instantaneous unit hydrograph (IUH) is parameterized in terms of Horton order ratios of a catchment on the basis of a geomorphologic model of catchment response. The shape parameter of the Nash model is dependent on Horton's aumbers R sub-A, R sub-B, and R sub-L, of a catchment. Therefore catchment geomorphology can provide a synthesis of the shape of the hydrologic response. The scale parameter of the Nash model insults to be a time varying character depending on both geomorphology and average streamflow velocity along the stream network. These two factors are taken separately into account. The assumption of a constant response function for a catchment is therefore related to the assumption of a constant tresponse. Since the IUH can be a time-varying characteristic, both throughout the storm and for different storms, this variability could be accounted for by the variability of the time scale of the IUH. Therefore the time scale of the IUH could account for the variability of the hydrologic response for different storms and throughout a storm. When compared with tradiscale of the IUH could account for the variability of the hydrologic response for different storms and throughout a storm. When compared with traditional regression formulae, these findings can substantially improve the prediction capability of the Nash model for catchments where no direct rainfall runoff analysis can be performed. (Baker-IVI)

ESTIMATION OF SKEWNESS OF HYDRO-

ESTIMATION OF SKEWNESS OF HYDRO-LOGIC VARIABLES, George Washington Univ., Washington, DC. International Water Resources Inst. V. Yevjevich, and J. T. B. Obeysekera. Water Resources Research, Vol. 20, No. 7 p 935-943, July, 1984. 12 Fig. 3 Tab, 21 Ref. NSF grant CEE-7916817.

Descriptors: *Skewness, *Hydrology, Probability, Mathematical studies, Simulation.

Mathematical studies, Simulation.

Various methods of estimation of the akewness coefficient of hydrologic random variables are compared with respect to bias, variance, mean square error, and robustness. The underlying population distributions are limited to gamma (Pearson type 3) and lognormal. The simulation results show that a new skewness estimator that uses the estimated covariance between the subsample mean and the subsample variance has a lesser bias than the ordinary skewness estimators. It may be used as a surrogate when the sample size is small and population skewness large. The superior estimates of skewness resulting from the maximum likelihood estimation of parameters of the known underlying distribution and robustness studies point to the importance of the correct inference on the type of underlying probability distribution function in hydrologic applications. (Author's abstract)

ADDITIONAL TESTS ON THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK FLOW FROM WILD-LAND

Georgia Univ., Athens. School of Forest Re-For primary bibliographic entry see Field 2E. W85-02166

2B. Precipitation

DROUGHT IN SOUTHEASTERN UNITED

SIAIES, Florida Univ., Gainesville. Dept. of Geography. J. A. Henry, and S. E. Dicks. Florida Scientist, Vol. 47, No. 2, p 114-129, Spring, 1984. 10 Fig. 1 Tab, 17 Ref.

Precipitation—Group 2B

Descriptors: *Drought, *Florida, *Georgia, *North Carolina, *South Carolina, *Tennesse, *Alabama, *Mississippi, Moisture deficiency, Weather patterns, Climatology, Eigenvector analysis, Palmer Drought Index.

Drought has been a significant, if not dominant, meteorological factor in the southeastern United States (Florida, Georgia, North Carolina, South Carolina, Tennesse, Alabama, and Mississippi) in recent years. Eigenvector analysis of Palmer Drought Index values for southeastern United States for 1931-79 reveals that the 1930s and 1950s states for 1931-7 reveals that the 1930s and 1930s experienced the most significant droughts. Generally, the dry conditions in the Southeast were less severe than those of the Midwest at the same time. Throughout the 1960s, conditions were generally normal to wet, with significant drought only in central and southern Florida. The 1971-79 period was significantly wetter than normal in nearly all of the Southeast. Moisture conditions in south-central and southern Florida are generally out of phase with the remainder of southeastern United States. (Collier-IVI) W85-01642

REVIEW OF RAINFALL DATA APPLICATION FOR DESIGN AND ANALYSIS, VIAK Consultants, Linkoeping (Sweden). V. Arnell, P. Harremoes, M. Jensen, N. B. Johansen, and J. Niemczynowicz. Water Science and Technology, Vol. 16, No. 8/9, p 1-45, 1984. 14 Fig, 4 Tab, 161 Ref.

Descriptors: *Rainfall, *Data processing, *Model studies, *Rainfall-runoff relationships, besign storms, Statistical analysis, Computer models, Computer studies, Storms, Floods, Prediction.

The introduction of computer technology has ande it possible to handle quantities of data un-heard just decades ago. Rain data is a good exam-ple of such masses of data that have become avail-able for statistical analysis. The state of the art within the following areas was reviewed: 1) the statistical characterization of rainfall in time and statistical characterization of rainfall in time and space, 2) the development of synthetic design storms and, 3) the application of both synthetic design storms and historical storms to pipe design, flooding prediction, design of detention basins and calculation of the yearly or extreme pollutional load on receiving waters from combined sewer overflows. The main conclusion, primarily related to item 3, is that more attention in this context should be put on statistical analysis of flooding and pollution. This analysis is best performed by applying historical rain records. Realistic flooding prediction is believed only to be possible with a fully ing historical rain records. Realistic flooding prediction is believed only to be possible with a fully dynamic flow model, whereas pollution may be studied by means of simpler models like the time area approach. The outstanding problem in statistical prediction is the distribution in space of the historical rains. (Collier-IVI) W85-01677

DESIGN STORM FOR A TROPICAL LOCA-TION WITH LIMITED DATA, Hydraulics Research Station, Wallingford (Eng-

P. J. Colyer.

Water Science and Technology, Vol. 16, No. 8/9, p 63-68, 1984. 4 Fig. 2 Ref.

Descriptors: *Design storms, *Model studies, *Urban drainage, *Tropical regions, *Trinidad, *Port of Spain, Urban watersheds, Rainfall intensity, Rainfall-runoff relationships, Rainstorms, Intensity, sity-duration-frequency curves

A computational model was produced of the improved urban storm drainage system of Port of Spain, Trinidad. Locally appropriate rainfall data were developed by first producing relationships between rainfall intensity, duration, and frequency (IDF) and then determining design storm profiles. Rainfall depths were obtained from an existing IDF. Design storm profiles were based on analysis of 100 storms recorded on two raingauges over a two year period (1980 and 1981). A clear tendency to advanced skewness in the profiles was discovered well over 50% of the spirit light. to advanced skewness in the profiles was discovered; well over 50% of the rainfall depth occured

in the first half of the storm. For the purposes of storm drainage analysis, the 100 storms could be divided into three types: a 'Diego Martin' type with very marked skewness and uneven distribution of intensity; a 'San Juan' type with less marked skewness; and a uniform intensity distribution. The computer programs were constructed to use values of the ratio Instantaeous intensity Mean intensity at 1% time intervals through the storm duration. These ratios were combined with a mean intensity from the IDF relationship to give a dimensional storm profile. The surface runoff model developed for urban conditions in Trinidad was calibrated using observed rainfall and runoff events. The calibrated model was then used within the design storm profiles described above to examine the behavior of the existing drainage system in Port of Spain and to design the necessary improvements. (Collier-IVI)

SYNTHETIC DESIGN STORM AND ITS RELA-TION TO INTENSITY-DURATION FREQUEN-

TION TO INTENSITE DURATION TO A CY CURVES,
Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Dept. of Sanitary Engineering.
P. Urcikan, and J. Horvath.
Water Science and Technology, Vol. 16, No. 8/9, p 69-83, 1984. 8 Fig. 3 Tab, 10 Ref.

Descriptors: *Czechoalovakia, *Design storms, *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, Rainstorms, Urban hydrology, Rainfall-runoff relationships.

New hydrodynamic deterministic models of rainfall-runoff processes in urban hydrology contributed significantly to development of statistical processing of natural rainfall as synthetic design storms. Design rainfalls have been applied in current hydrodynamic rainfall-runoff models; the course of design rainfalls may be simulated by means of several stochastic-mathematical models. Methods applied in developing design storms with optional time position of intensity maximum with increasing and decreasing intensity course, expressed by means of exponential equations were analyzed. The medium value of the intensity maximum time position tmax/td = 0.317 was identified in eight recording raingauge stations from the set of actual tion timax/tid = 0.31/ was identified in eight re-cording raingauge stations from the set of actual rainfalls of a five-year evaluation period. The design storms will be applied in the future in Czechoslovakia in cases where a more reliable design storm with a variable intensity course, having a character of a stochastic design storm cannot be obtained. (Collier-IVI)

STATISTICAL METHODS OF STORM ANALY-

SIS, Agricultural Research Service, Beltsville, MD. Hydrology Lab. V. D. Vukmirovic, and J. Z. Despotovic. Water Science and Technology, Vol. 16, No. 8/9, p 85-92, 1984. 8 Fig, 7 Ref.

Descriptors: *Intensity-duration-frequency Curves, *Model studies, *Rainfall distribution, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity, Urban runoff.

Complex information concerning small duration high intensity rainfall is useful for both hydrologist and design engineer and also necessary for urban run-off calculations and drainage system analysis. Return period for a rainfall depth could be determined by an analysis of the annual maxima sample rainfalls for a given duration. That analysis consists of the following three methods: annual maxima method, peaks over threshold method (POT is known as 'partial duration series'), and compound POT. For the defined duration D, relations among D, return period R and rainfall depth X can be evaluated; if there is a need for some more information, it is necessary to analyze the rainfall intensity variations during a rainfall. The storm pattern itself is a random variable that can be defined by a two-dimensional distribution function from which a synthetic storm pattern could be obtained. The distribution function could be interpreted as the probability of a pattern shape appearance. A date

in a year when annual maxima Xmax of given duration appears is a random variable d; its distribution function can be defined. The recorded data could be used for the random variable d, transforming the dates into numbers from 1 to 365. This sample could be used for an annual maxima method analysis. An analysis consisting of all three above methods was applied to 57 years of record rainfall data covering the period 1925 to 1981. The annual maxima method was the most simple and the results of this method could be evaluated rapidly. The compound POT method takes more time ly. The compound POT method takes more time to get complete information about the storm. (Collier-IVI) W85-01680

SOME STATISTICAL PROPERTIES OF SHORT-DURATION RAINFALL,
Belgrade Univ. (Yugoslavia). Faculty of Civil En-

gineering.
D. M. Hershfield.
Water Science and Technology, Vol. 16, No. 8/9, p 93-100, 1984. 10 Fig. 5 Ref.

Descriptors: *Rainfall distribution, *Model studies, *Rainstorms, Urban hydrology, Storms, Rainfall-runoff relationships, Rainfall intensity.

Information on the nature of rainfall characteristics in time and space associated with storms in the mid-latitudes is indispensable for the cost-effective design of various hydraulic structures. Examination of storm data and climatological quantities from both dense raingage networks and individual stations in the United States elucidated some of the hemocates are designed to the control of the contro important problems in developing drainage design criteria for small areas. Using 5-min increments, for criteria for small areas. Using 5-min increments, for hundreds of storms, the average of the maximum 5-min values was determined to be about 40% of the 60-min amount. The rates of the incoming storm rainfall can vary greatly over a small area but the cumulations during the storm period tend to equalize the storm totals. An 'average' time distribution curve was developed along with relationships between rainfall amounts for durations from 2- to 60-min. A procedure was used for estimating and comparing six quantities from series of annual maximum rainfalls for several short durations. The quantities included a frequency factor, 100-yr value, the probable maximum rainfall, and the observed world maximum rainfalls. (Collier-IVI)

RAINFALL AS THE BASIS FOR URBAN RUNOFF - EXPERIENCE AND PRACTICE IN YUGOSLAVIA,

Split Univ. (Yugoslavia). Faculty of Engineering. O. Bonacci.

Water Science and Technology, Vol. 16, No. 8/9, p 101-108, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Rainfall distribution, *Urban runoff, *Yugoslavia, *Rainfall-runoff relationships, Model studies, Rainstorms, Intensity-Duration-Frequency curves, Urban hydrology, Storms, Rainfall intensity, Discharge hydrographs, Hydrographs.

The objective of each study of intensive rainfall and its further application in runoff processes is to define intensity-duration-frequency (IDF) curves. When reading pluviograph records the maximum values of all types of rainfall, regardless of the intervals occuring in intensive rainfall, should be taken into account. In choosing between the partial duration series, annual maxima series, or peaks duration series, annual maxima series, or peaks over a threshold (POT) series, theoreticians prefer the POT series, whereas engineers in practice mostly avoid it. The application of the POT series mostly avoid it. The application of the POT series is more complex than other types of series as it poses certain constraints related to the distribution of occurences of peaks higher the threshold value H sub b. IDF curves should be plotted by defining two families of IDF curves, the first for the period ranging from 5 min to 60 or 120 min and the second for the period from 60 or 120 min up to 24 hours; this method should be used as opposed to plotting for the period ranging from 5 min to 24 hours. In Yugoslavia there are about 220 pluviographs and 3000 rain gauge stations with daily data recordings over an area covering 255,804 sq km.

Field 2-WATER CYCLE

Group 2B—Precipitation

High variability and significant changes in characteristics of intensive rain in space and time, particularly the direction of storm movement, significantly affect the formation of runoff processes, i.e. outflow hydrograph. The genetic method for computing the runoff process should be used based on the definition of isochrones applied to dynamic programming. (Collier-IVI) W85-01682

DEPTH-DURATION MODELS OF SHORT TIME INCREMENT RAINFALL, Purdue Univ., Lafayette, IN. Dept. of Civil Engi-

Neering. A. R. Rao, and B. T. Chenchayya. Water Science and Technology, Vol. 16, No. 8/9, p 109-130, 1984. 9 Fig, 5 Tab, 10 Ref.

Descriptors: *Depth-area-duration analysis, *Urban runoff, *Rainfall-runoff relationships, Rainfall intensity, Model studies, Rainfall distribution, Rainstorms, Urban hydrology, Storms.

The short increment rainfall depth values corresponding to given frequencies and durations are frequently used in urban storm drainage design. The depth-duration characteristics of short time increment (10 min. and hourly) rainfall sequences, and proposed models of the depths and durations, were investigated as was the effect of different time scales on modeling the process. Regression models of depth and duration data as well as bivariate gamma distribution were used for analysis of hourly and 10-minute rainfall measured at Laragette, Indiana. Regression models for storm depth-duration relationship are adequate when they are used with appropriately classified storms. Significant differences and some surprising similarities were found in the characteristics of short time increment rainfall processes in different climatic regions. The characteristics of the 10 minute and hourly data are quite similar to each other. (Collier-IVI) lier-IVI) W85-01683

RAINFALL EVENTS AS PATHS OF A STO-CHASTIC PROCESS: PROBLEMS OF DESIGN STORM ANALYSIS, Technische Univ., Munich (Germany, F.R.). Lehr-stuhl und Pruefant fuer Wassergutewirtschaft und

Gesundheitsingenieurwesen.

J. Brummer.

Water Science and Technology, Vol 16, No. 8/9, p
131-138, 1984. 1 Fig. 2 Tab, 4 Ref.

Descriptors: *Rainfall, *Stochastic proc *Design storms, Rainfall-runoff relationsh Rainfall intensity, Catchment area, Flood po

For questions of temporal and spatial intensity distribution of precipitation events, frequency of precipitation characteristics and for the construction of representative rainstorm events (design storm analysis), a survey of the distribution of completed rainfall events is sufficient. Of interest completed rainfall events is sufficient. Of interest are the possible variability patterns of rainfall events and their probability distribution (relative frequency of appearance). A concept is introduced for approximating natural peak flow value by means of the distribution of typical rainfall paterns. A comparison demonstrates the quality of means of the distribution of typical rainfall paterns. A comparison demonstrates the quality of this concept and the competency of some well-know design storms for the adequate evaluation of peak flows. The approximation of the natural values by the value resulting from the weighted rainfall patterns, succeeds well for relatively small catchment areas. A slight, continuously increasing underestimation of the natural values begins only in the areas with more than 100 ha of total surface. (Moore-IVI) W85-01684

UNIVARIATE VERSUS MULTIVARIATE RAINFALL STATISTICS - PROBLEMS AND

POTENTIALS, Hanover Univ. (Germany, F.R.). Inst. fuer Wasser-wirtschaft, Hydrologie und Landwirtschaftlichen W. Schilling.

Water Science and Technology, Vol. 16, No. 8/9, p 139-146, 1984. 10 Fig. 3 Ref.

Descriptors: *Urban hydrology, *Rainfall, *Statistics, *Multivariate analysis, Mathematical studies, Design storms, Rainfall distribution.

ns of conventional (univariate) rainfall staitstics are discussed. Advanced problems in urban hydrology include design of detention reservoirs, computation of pollution loads and other features. computation of pollution loads and other features. For each of these tasks the conventional statistical treatment of rainfall data causes particular problems since hydrographs rather than peak flows are relevant for the final result. Implications of rainfall probability on probability of reservoir failure or pollution loads are extremely unreliable. Similar problems occur if a design storm is to be defined, because conventional rainfall statistics do not provide any rule how to order a sequence of rainfall because conventional rainfall statistics do not pro-vide any rule how to order a sequence of rainfall intensities. A multivariate approach is presented which treats rainfall as a sequence of independent events, takes care of the temporal structure and eventually also takes care of the spatial structure of rainstorms. (Baker-IVI)

STOCHASTIC CHARACTERIZATION OF TEMPORAL STORM PATTERNS, Quebec Univ., Chicoutimi. Dept. des Sciences Ap-

V. T. V. Nguyen. Water Science and Technology, Vol. 16, No. 8/9, p 147-153, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Rainstorms, *Rainfall distribution, Probability distribution, Montreal, Quebec, Storms, Precipitation.

Quebec, Storms, Precipitation.

A general stochastic model for characterizing the temporal pattern of storms was developed which can take into account both the persistence in hourly rainfall occurences and the dependence between successive hourly rainfall depths; a storm is defined as a continuous run of non-zero one-hour rainfall depths. The model determines the probability distributions of cumulative storm rainfall amounts at successive time intervals after storm the begins. Hourly rainfall data from Dorval Airport station, on the Island of Montreal, for a total of 2560 summer rainfall events having durations of from 1 to 27 hours were selected from a 32-year record (1943-1974) according to the definition of a storm specified above. The serial correlation coefficient was assumed to be stationary and its computed sample values were used in the estimation of the probability distribution functions for cumulative rainfall amount. By accounting for the correlation structure of consecutive rainfall depths the model gives a good fit to the observations. Use of the model for analytically constructing distributions of cumulative rainfall amounts at successive time intervals seems preferable to the simulation or fitting approaches that have been used in previous investigations. (Collier-IVI)

TIME PATTERNS OF RAINFALL FOR ESTI-MATING DESIGN FLOODS ON A FREQUEN-CY BASIS,

CY BASIS, New South Wales Univ., Kensington (Australia). School of Civil Engineering. I. Cordery, D. H. Pilgrim, and I. A. Rowbottom. Water Science and Technology, Vol. 16, No. 8/9, p 155-165, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Rainfall, *Design floods, *Rainfall distribution, Frequency distribution, Floods, Urban hydrology, Model studies, Flood peak, Maximum probable floods.

The rainfalls used in the practical estimation of design floods are generally based on frequency-duration relationships derived from recorded intense bursts of rainfall of various durations rather than from complete storms. These recorded intense bursts are therefore used in the derivation of the temporal patterns. The method produces patterns that incorrogate the average variation of intensities

that incorporate the average variation of intensities and the most likely sequence of these varying intensities. Use of these patterns should minimize the introduction of joint probabilities into the design flood model and aid in estimation of a flood with the same frequency as the design rainfall. The

method provides patterns with average or typical variations in intensity, in contrast to simple averaging which is shown to be generally unlikely to yield satisfactory patterns. The derived patterns are shown to provide peak flood estimates which are higher than those given by constant intensity storms but lower than rearrangements of the frequency-duration relationships. (Author's abstract) W85-01687 method provides patterns with average or typical

TEMPORAL DISTRIBUTION OF DESIGN STORM RAINFALL,
National Water Research Inst., Burlington (Ontar-

Water Science and Technology, Vol. 16, No. 8/9, p 167-175, 1984. 3 Fig, 19 Ref.

Descriptors: *Design storms, *Rainfall distribution, *Simulated rainfall, Rainstorms, Rainfall simulators, Urban hydrology, Rainfall-runoff relationships, Runoff forcasting.

ships, Runoff forcasting.

The temporal distribution of rainfall intensity is one of the most important characteristics of the design storm. This distribution, and in particular its peak intensity and the peak timing, significantly affect the runoff peaks simulated for small urban catchments of significant imperviousness. Various methods for the development of design storm temporal distributions, recommended in the literature, produce widely varying temporal distributions. Such differences in design storm hyetographs can be noticed for the peak magnitude and timing as well as for the overall distribution. Some methods may even produce different rainfall depths for identical return periods and durations. As a consequence of differences in design hyetographs, the simulated runoff peaks will differ as well. The extent of variations in runoff peaks simulated for various design hyetographs will be affected by the catchment response and the selected rainfall interval and the computational time step. Further comparative studies and exchange of experience are recommended. (Collier-IVI)

EFFECT OF SPATIAL RAINFALL DISTRIBU-

TION ON SEWER FLOWS, Hanover Univ. (Germany, F.R.). Inst. fuer Wasser-wirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau

For primary bibliographic entry see Field 2E. W85-01689

AREAL REDUCTION FACTORS ON SHORT TIME AND SPACE INTERVALS,

Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique. M. Desbordes, P. Raous, and Y. Trevisiol.

Water Science and Technology, Vol. 16, No. 8/9, p 189-198, 1984. 3 Fig, 4 Tab, 3 Ref.

Descriptors: *Areal precipitation, *Rainfall-runoff relationships, *Rungis, *France, Rainfall intensity, Drainage area, Intensity-duration-frequency Drainage

In most research studies on rainfall-runoff processes, rainfall intensities over the experimental catchments are measured by means of a few raingages. An experimental dense raingage network on the Rungis catchment, France, composed of 9 raingages, covering approximately 300 to 400 hectares, was monitored for three years. Areal reduction factors on short time and space intervals were determined from 51 events ranging from 5 minutes to 4 hours. Mean rainfall intensities should not be considered to be uniformly distributed over small areas ranging from 100 to 400 hectares and for durations less than one hour. For storm drainage design purposes, one should remember that areal reduction factors are random variables; the areal distribution of rainfall should be taken into account be means of Areal Intensity-Duration-Frequency curves. If these are unknown, one should use mean areal reduction factors defined from point rainfall, rather than mean reduction factors which are defined from maximum point rainfall, observed over

Precipitation—Group 2B

a given area. Rainfall-runoff balances at the catchagree area. Rannan-runoit banances at the carcin-ment outlet have confirmed the influence of rain-gage network density. The minimum 50 to 100 hectares mesh size seems to be suitable. (Collier-IVI) W85-01690

NORWEGIAN ACTIVITIES ON COLLECTION AND RESEARCH ON RAINFALL DATA, Norsk Inst. for Vannforskning, Oslo.

O. Lindholm. Water Science and Technology, Vol. 16, No. 8/9, p 199-205, 1984. 4 Fig, 1 Ref.

Descriptors: *Norway, *Rainfall distribution, *Rainfall intensity, Pluviographs, Rain gages, Data collection, Hydrologic data, Area reduction fac-

Many Norwegian communities are located near mountains, valleys, and hills; this topologic diversity caused very big variations in rain intensity from place to place. Due to this condition, a network of monitoring stations for monitoring short-time preciptation is required. There are ca. 50 tipping bucket pluviographs in Norway recording on magnetic tape. These pluviographs (called PLUMA-TIC) are maintained by the Norwegian Meteorological Institute (MI) which also process the datapes and distributes information and results from the stations. Spatial rainfall distribution was compared with point measurements based on 5 years of data from 6 PLUMA-TICS in the Oslo area The area reduction factor calculated from this data decreased rapidly up to 10 sq km and a further increase in this area gives a much slower decrease in the reduction factor. (Collier-IVI) W85-01691

DESIGN INFLOW INTENSITY AND DESIGN INFLOW PROFILES FOR STORM SEWERS, Rijksdienst voor de Ijsselmeerpolders, Lelystad (Netherlands).

For primary bibliographic entry see Field 2E.

EVALUATION OF URBAN DESIGN STORM SENSITIVITY.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

H. G. Wenzel, Jr., and M. L. Voorh Water Science and Technology, Vol. 16, No. 8/9, p 219-236, 1984. 6 Fig. 6 Tab, 20 Ref. Office of Water Resources and Technology project A-095-

Descriptors: *Design storms, *Urban drainage, *Drainage systems, Design criteria, Rainfall distribution, Drainage, Urban hydrology, Storm sewers, Depth-duration-frequency analysis, Frequency

Traditionally, in the design process for urban drainage systems, a precipitation event, either historical or artificial, is identified and the system under study is designed to accommodate that event. This event is usually selected on the basis of a target return period. It is then assumed that the probability of the design capacity being exceeded is the same as the probability of the magnitude of the design storm being exceeded. The sensitivity of the frequency response of three catchments to design storm parameters was examined; parameters included hystograph shape, antecedent soil moisture condition (AMC), and rainfall duration. A continuous simulation model was used to compute simulated historical frequency responses for three continuous simulation model was used to compute simulated historical frequency responses for three different long term rainfall records. Design storms were also developed from depth-duration-frequency analysis of the rainfall data; comparisons were made on frequency graphs. The hyetograph used for the design storm can significantly affect the return period of the resulting design. AMC can have as much affect on the frequency response of have as much affect on the frequency response of peak flows as hyetograph shape. The time of con-centration of the catchment serves as a good guide to determine the duration of the design storm to be to determine the duration of the design storm to be used. Significant parameter sensitivity exists but an appropriate choice of design storm parameters can produce a design which yields peak flows of the desired return period. (Collier-IVI) W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CAL-CULATIONS, Technical Univ. of Denmark, Lyngby. Dept. of

nitary Engineering.

r primary bibliographic entry see Field 2E.

RAINFALL DATA FOR THE DESIGN OF DE-TENTION BASINS, VIAK Consultants, Linkoeping (Sweden). For primary bibliographic entry see Field 2E. W85-01695

RAINFALL ENERGY FROM DROP SIZE

DATA,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
R. G. Quimpo, and A.-B. Brohi.
Water Science and Technology, Vol. 16, No. 8/9,
p 271-283, 1984. 5 Fig. 2 Tab, 25 Ref.

Descriptors: *Rainfall energy, *Fluid drops, *Kinetic energy, *Erosion rates, Precipitation intensity, Storms, Rainfall intensity.

With the availability of raindrop size distribution data, it is now possible to examine the energy content of storms and approximate more closely their erosion potential. The washoff of pollutants from urban surfaces by storm events depends on the kinetic energy of storms. In order to determine the erosive power of rainfall, data on raindrop size distributions were analyzed and the kinetic energy was expressed as a function of rainfall intensity. Because rainfall intensities vary during the storm, the energy should be calculated from the varying drop size distribution during the storm rather than from the extrapolate¹ distribution from short duration sampling. The regression equation that is currently used to determine storm erosive power from rainfall intensity needs to be revised. (Collier-IVI) W85-01696

OVERFLOW DATA OF RAINWATER DIS-CHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH

RECORDS, Lautrich and Pecher, Dusseldorf (Germany, F.R.). For primary bibliographic entry see Field 2E. W85-01698

REAL-TIME ESTIMATION AND FORECAST-ING OF SPATIALLY DISTRIBUTED AREAL RAINFALL, Hanover Univ. (Germany, F.R.). Inst. fuer Wasser-wirtschaft, Hydrologie und Landwirtschaftlichen

W. Schilling.

Water Science and Technology, Vol. 16, No. 8/9, p 327-348, 1984. 9 Fig. 5 Tab, 30 Ref.

Descriptors: *Rainfall distribution, *Forecasting, *West Germany, *Areal rainfall, Point rainfall, Kalman filter model, Thiessen procedure, Radar, Weather forecasting, Model studies.

A simple multivariate autoregressive model was developed that quantitatively and automatically forecasts spatially distributed point rainfall for short lead times. For calibration and testing of the point model, data of the "Emschergenossenscchaft" in the Ruhr District, West Germany, were used. The data was assumed to be remotely transmitted; only remotely-transmitted standard raingage data is necessary for model operation. A reliable estimation procedure for areal rainfall should take into account the actual uncertainty of taking the point rainfall as areal rainfall for each specific raingage/subarea. The point model was expanded to foreast and also estimate areal rainfall from point measurements using the Kalman filter technique and the theory of regionalized variables. X-Band-Radar data from the Swist catchment near Bonn was used for verification of the areal rainfall model. In each A simple multivariate autoregressive model was

of 20 measurement periods the Kalman filter estiof 20 measurement persons the rammater outperformed the standard measurements. The Kalman filter model is superior for areal rainfall estimation (compared to the Thiessen procedure) as well as for areal rainfall forecasting compared to trivial forecasts and the point forecasting model mentioned above. (Collier-IVI) W85-01700

POTENTIAL URBAN RAINFALL PREDICTION MEASUREMENT SYSTEM,

Illinois State Water Survey Div., Champaign. J. L. Vogel.

Water Science and Technology, Vol. 16, No. 8/9, p 349-362, 1984. 1 Fig, 1 Tab, 33 Ref. NSF grant PFR78-05693.

Descriptors: *Urban rainfall, *Weather forecasting, *Rainfall distribution, *Chicago, *Illinois, Radar, Computers, Rainstorms, Storms, Rain gages, Man-

Present raingage systems in many metropolitan regions are capable of monitoring the amount of rain that falls, but unless the raingage network is very dense, extends prohibitively far from the city, and is connected with a computer system to analyze the storm movement, the raingages are not capable of predicting future precipitation patterns and amounts. Continued growth of urban regions and more stringent water quality regulations have resulted in an increased need for more real-time information about past, present, and future patterns and intensities of precipitation. A new prediction/monitoring system for more efficient management of the complex Chicago storm-sewer operational needs consists of five major elements: a 10-cm weather radar incorporating a signal processor; a weather radar incorporating a signal processor; a mini-computer system to analyze the echo data, provide rainfall amounts over the city, and forecast provide rainfall amounts over the city, and forecast rain which was to occur over the city; telemetered rainfall data from the existing recording raingages of the Sanitary District; meteorologists and standard routine weather facilities; and a communication system connecting the radar and raingages to water control headquarters. The adjunct computer system translates the digital radar data into the rainfall estimates by integrating the raingage-indicated rainfall with the radar signal. It also calculates the motion and rain change fields needed to predict urban rainfall. (Collier-IVI) W85-01701

STOCHASTIC DESCRIPTION OF TEMPORAL DAILY RAINFALL PATTERNS,

Quebec Univ., Chicoutimi. Dept. des Sciences Ap-

V.-T.-V. Nguyen.

Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 234-238, June, 1984. 4 Fig, 14 Ref.

Descriptors: *Stochastic process, *Model studies, *Rainfall, Montreal Island, Quebec, Temporal distribution, Rainfall amount, Rainfall distribution,

A stochastic approach to characterization of tem-poral patterns is proposed wherein a rainfall event is defined as an unbroken sequence of consecutive daily rainfalls. A stochastic model is developed to determine the probability distribution of cumula-tive rainfall amounts at the end of each day within a total rainfall event duration of n days. The model is structured such that the distribution of daily rainfall depths can be approximated by an expo-nential distribution and the rainfall occurrence nential distribution and the rainfall occurrence process can be described by a first-order stationary Markov chain. An illustrative example was presented, using a 32-year daily rainfall record at Dorval Airport on Montreal Island. The results of this example have demonstrated the adequacy and descriptive capabilities of the model. It can be concluded that the methodology proposed seems to be more general and more flexible than those that have been used in previous investigations. that have been used in previous investigations. (Author's abstract) W85-01712

Field 2—WATER CYCLE

Group 2B—Precipitation

CASE STUDY OF HEAVY RAIN SPELL ON 13TH-25TH DECEMBER 1982 OVER THE EAST COAST OF PENINSULAR MALAYSIA AND

Singapore Meteorological Service. C. Tik.

Journal of the Meteorological Society of Japan, Vol. 62, No.2, p 296-307, April, 1984. 9 Fig. 8 Ref.

Descriptors: *Peninsular Malaysia, *Malaysia, *Singapore, *Rainfall, Hadley cell, Wind, Monsoons, Convergence, Air circulation.

soons, Convergence, Air circulation.

The continuous heavy rain spells over the east coast of Peninsular Malaysia and Singapore are frequently associated with the onset phase (November-December) of the northeast winter monsoon, but the mechanism of the heavy rain spells is not well understood. The Hadley cell over the east coast of Peninsular Malaysia and Singapore was studied by means of meridional wind components and vertical p-velocities for the period of the heavy rain spells from 13th to 25th December 1982. The formation of the heavy rain spells over the east coast of Peninsular Malaysia and Singapore are mainly caused by strong upward motions of moist air in the southern branch of the Hadley cell. Some cases may also be explained by the maximum upward velocities in the mid-troposphere due to the upward branch of the Hadley cell circulation. The maximum upward velocities in mid-troposphere are caused by the combination of strong low-level convergence and the initial appearance of the equatorial cell in the southern branch of the Hadley cell. (Moore-IVI)

AGRICULTURAL DROUGHTS AT PEDDA-PURAM, EAST GODAVARI DISTRICT, ANDHRA PRADESH, Andhra Univ., Waltair (India). Dept. of Meteorol-

ogy and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02126

2C. Snow, Ice, and Frost

ICE COVER MELTING IN A SHALLOW

Cold Regions Research and Engineering Lab. Hanover, NH.

D. J. Calkins. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 255-265, June, 1984. 11 Fig. 4 Tab, 9 Ref.

Descriptors: *Ice cover, *Melting, *Heat transfer, Water temperature, Diurnal variation, Solar radi-ation, Frazil ice, River flow, Velocity, Water depth, Air temperature.

The heat transfer coefficients computed from field data on both ice cover melting and water temperature attenuation are higher than the values one would compute based on extrapolation of previous laboratory flume data. The computed heat transfer coefficients were relatively consistent when calculated from the present the present that the contract of the present that the present lated from the water temperature decay data. Consistent results were also obtained with one set of isted from the water temperature decay data. Consistent results were also obtained with one set of very detailed ice cover melting data. The diurnal fluctuation in water temperature from the freezing point to values of 0.4-0.6 degrees C was associated with the incoming solar radiation and the open water surface area. The measured water temperature distribution beneath the ice cover at a particular cross section varied from 0.2 to 0.6 degrees C due to the influence of frazil ice and flow distribution. In the open water reaches the water temperature was essentially fully mixed vertically but lateral variation across the river ranged from 0.1 to 0.3 degrees C. The average daily melting of the ice cover often exceeded 5.0 cm and at some locations the rive was as high as 8 cm/d. The melt was not uniform across the section but was highly dependent upon the flow conditions, velocity, and depth. The ice cover melting for this year only occurred during the daylight hours as the air temperature acropped below 0 degrees C at right and the water temperature likewise decayed to its freezing point. (Author's abstract) W85-01713 W85-01713

CALCULATION OF MELT-WATER DIS-CHARGE FROM THE SNOW COVER IN CATCHMENT AREAS IN THE MITTELGE-BIRGE MOUNTAINS (BERECHNUNG DER SCHMELZWASSERABGABE AUS DER SCHNEEDECKE IN EINZUGSGEBIETEN DES

Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie. G. Flemming, and J. Gurtz. Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 64-66, February, 1983. 4 Fig, 10 Ref.

Descriptors: *Snowmelt, *Mittelgebirge Mountains, *East Germany, *Computer models, Temperature, Snow cover, Precipitation, Catchment area, Mountains, Evaporation.

Computer models for calculating snow melt-water discharge were used to predict discharge patterns in two catchment areas (the Schwarzwasser to the Aue gauge and the Lipperndorfer Bach) in the Mittelgebirge, a mountain range in the German Aue gauge and the Lippersdorfer Bach) in the Mittelgebirge, a mountain range in the German Democratic Republic. The models are based on the daily degree procedure, in which the major factor is temperature, with minor factors of precipitation and snow-cover data. They consist of a frame section and a core section: the former controls program organization and the division of the catchingth area into an optional number of levels. catchment area into an optional number of levels based upon height above sea-level, which may then be subdivided into bare and forested surfaces; the latter describes snow-cover accur the latter describes snow-cover accumulation, snow melt, and melt-water retention. The SMELT 4 model offers the capability of including not only the mean temperature for each time interval but also the duration of positive (i.e., causing melting) temperatures. Melt intensity, expressed by the so-called degree factor, depends on the amount of water in the snow cover at the beginning of the calculation. SMELT 5 is a physically expanded version of SMELT 4; the melt component is series-connected to components for evaporation and version of SMLET *s, the line Component is series-connected to components for evaporation and time-dependent accumulation of the snow cover. The models provide a useful base for studying the discharge process in winter and for calculating river flow in general using catchment-area models. (Gish-IVI) W85-01972

2D. Evaporation and Transpiration

WATER-USE PRODUCTION FUNCTIONS OF WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTH-WESTERN NEW MEXICO, PHASE II, New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 3F. W85-01817.

2E. Streamflow and Runoff

CRITICAL DEPTHS FOR PASSAGE IN BRAID-ERITEAL DEPTHS FOR PASSAGE IN BRAID-ED RIVERS, CANTERBURY, NEW ZEALAND, Ministry of Works and Development, Christ-church (New Zealand). M. P. Mosley. New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 351-357, 1982. 7 Fig, 4 Ref.

Descriptors: *Canterbury, *New Zealand, *Ashley River, *Hurunui River, *Braided streams, *Rakaia River, Water depth, Stream flow, Minimum flow.

Riffles and points of divergence of branch channels in braided rivers are critical controls upon passage of fish and recreational boats because they are points at which depths are at a minimum. Depths on randomly selected riffles were measured in braided reaches of the Ashley, Hurunui, and Rakaia Rivers and related to discharge; minimum depths encountered in extended reaches of these rivers at a range of flows have also been measured. The data can be used to predict minimum available passage depths at a specified flow, or conversely, to predict the discharge required to maintain a specified minimum passage depth. However, presently available estimates of critical minimum depths required for various instream uses (migra-

tion of salmonids, jetboating) appear excessively conservative, and minimum depth requirements must be more accurately determined before instream flow needs can be properly assessed. (Author's abstract) W85-01636

FLOOD-PLAIN MANAGEMENT PROGRAM IN RAPID CITY, SOUTH DAKOTA, South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological En-

gineering.
P. H. Rahn.
Geological Society of America Bulletin, Vol. 95,
No. 7, p 838-843, July, 1984. 7 Fig, 16 Ref.

Descriptors: *Rapid City, *South Dakota, *Flood plain management, Floodways, Flood plains, Flood damage.

Following the devastating flood of June 9, 1972, Rapid City, South Dakota, embarked on a flood-plain management program. A 'floodway' was delinated and all homes and motels, as well as most commercial establishments, were removed from the floodway. Almost the entire area inundated by the 1972 flood is now a beautiful park, illustrating that man can live in harmony with natural processes without spending vast sums of money for hard engineering structures such as dams or levees. From a national perspective, it is desirable to reserve flood plains for agricultural use. Unfortunately, many flood plains are being urbanized, which not only take agricultural land out of production, but also gives impetus to dam construction that results in the inundation of more land. (Author's abstract)

REVIEW OF RAINFALL DATA APPLICATION FOR DESIGN AND ANALYSIS,

VIAK Consultants, Linkoeping (Sweden). For primary bibliographic entry see Field 2B. W85-01677

DESIGN STORM FOR A TROPICAL LOCA-TION WITH LIMITED DATA, Hydraulics Research Station, Wallingford (Eng-

land). For primary bibliographic entry see Field 2B. W85-01678

SYNTHETIC DESIGN STORM AND ITS RELA-TION TO INTENSITY-DURATION FREQUEN-CY CURVES.

CTCORVES, Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Dept. of Sanitary Engineering. For primary bibliographic entry see Field 2B.

STATISTICAL METHODS OF STORM ANALY.

SIS, Agricultural Research Service, Beltsville, MD. Hydrology Lab. For primary bibliographic entry see Field 2B. W85-01680

RAINFALL AS THE BASIS FOR URBAN RUNOFF - EXPERIENCE AND PRACTICE IN YUGOSLAVIA,

Split Univ. (Yugoslavia). Faculty of Engineering. For primary bibliographic entry see Field 2B. W85-01682

DEPTH-DURATION MODELS OF SHORT TIME INCREMENT RAINFALL, Purdue Univ., Lafayette, IN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01683

RAINFALL EVENTS AS PATHS OF A STO-CHASTIC PROCESS: PROBLEMS OF DESIGN STORM ANALYSIS,

Streamflow and Runoff-Group 2E

Technische Univ., Munich (Germany, F.R.). Lehrstuhl und Pruefamt fuer Waszergutewirtschaft und Gesundheitsingenieurwesen. Gesundheitsingenieurwesen.
For primary bibliographic entry see Field 2B.
W85-01684

TIME PATTERNS OF RAINFALL FOR ESTI-MATING DESIGN FLOODS ON A FREQUEN-CY BASIS, New South Wales Univ., Kensington (Australia). School of Civil Engineering. For primary bibliographic entry see Field 2B. W85-01687

TEMPORAL DISTRIBUTION OF DESIGN STORM RAINFALL, National Water Research Inst., Burlington (Ontar-

io).

For primary bibliographic entry see Field 2B. W85-01688

EFFECT OF SPATIAL RAINFALL DISTRIBU-

TION ON SEWER FLOWS, Hanover Univ. (Germany, F.R.). Inst. fuer Wasser-wirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau. W. Schilling.

Water Science and Technology, Vol. 16, No. 8/9, p 177-188, 1984. 10 Fig, 8 Ref.

Descriptors: *Rainfall distribution, *Sewer hydrau-lics, *Rainfall-runoff relationships, Urban hydrolo-gy, Runoff forecasting, Runoff rates, Artificial

When using a runoff model to generate input data for statistical computations, e.g. water balance, urbanization effects, design of dams, etc., the input data and the runoff model should produce flow features which are correct on the average; the computed probability density function of peak, volume, and time-to-peak should not differ radically from the true ones. Errors in computing flows are caused by uncertainties about input data as well as uncertainties about appropriate models and model parameters. Errors of the input 'rainfall', especially errors in spatial resolution, propagate by computation of sewer flows. Results of a case study about a sewer system with a catchment area of 2 sq km and ca. 1000 reaches between manholes show - that mean errors in rainfall event depths of about 20% occur even with five raingages within or close to the catchment - that the errors by disregarding the spatial distribution are amplified rather than damped by the rainfall-runoff transformation and - that using spatially homogeneous rainfall input for flow computations cause systemic errors due to the wrong assumption of spatially homogeneous initial losses and due to dominating directions of storm movement. When using artificial storms, the spatial and temporal rainfall variability should be taken into account. (Collier-IVI) W85-01689

AREAL REDUCTION FACTORS ON SHORT TIME AND SPACE INTERVALS, Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique. For primary bibliographic entry see Field 2B. W85-01690

DESIGN INFLOW INTENSITY AND DESIGN INFLOW PROFILES FOR STORM SEWERS, Rijksdienst voor de Ijsselmeerpolders, Lelystad (Netherlands).
F. H. M. van de Ven.
Water Science and Technology, Vol. 16, No. 8/9, p 207-218, 1984. 5 Fig, 5 Tab, 7 Ref.

Descriptors: *Storm sewers, *Design inflow intensity, *Design inflow profiles, *Netherlands, *Lelystad, *Sewer hydraulics, Sewers, Rainfall distribution, Discharge frequency, Depth-duration-fre-

Twelve year records of rainfall and of sewer inflow data in a housing area and in a parking lot in Lelystad, The Netherlands, were available. These

data series contained 5-minute depths of rainfall and sewer inflow. Depth-duration-frequency curves were calculated from the monthly extremes, using Box-Cox transformation and a Gumbel distribution. The differences between the curves for rainfall and for inflow are explained by inertia and rainfall losses. These differences are the reason to use inflow as a sewer design parameter. For the choice of the design discharge (or inflow) intensity the curves are not well suited. Storage-design, discharge-frequency curves proved to be better interpretable. The selected design discharge is 4 or 5 cu m/s/sq km. For non-steady flow calculations in sewer systems an inflow profile has to be provided. The profile should be peaked. The most common location of the peak lies between 20 and 50% of the event duration. The return period of the profile has to be known. A bivariate extreme value distribution is used to estimate this return period. From these distributions synthetic inflow profiles could be calculated. (Author's abstract) W85-01692

EVALUATION OF URBAN DESIGN STORM SENSITIVITY,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W85-01693

STAGED APPROACH TO APPLICATION OF RAINFALL DATA TO URBAN RUNOFF CAL-CULATIONS, Technical Univ. of Denmark, Lyngby. Dept. of

Sanitary Engineering.
P. Harremoes, M. Jensen, and N. B. Johansen.
Water Science and Technology, Vol. 16, No. 8/9, p 237-250, 1984. 6 Fig, 15 Ref.

Descriptors: *Urban runoff, *Urban hydrology, *Rainfall distribution, *Denmark, Intensity-duration-frequency curves, Model studies, Mathematical studies, Computer programs.

cal studies, Computer programs.

A coherent staged approach to application of rain data from long rain records to urban storm drainage has been developed in Denmark and is in the process of being implemented at the central computer center of the Danish municipalities. The approach is based on the principal that a spectrum of methods should be made available to the practitioner, from the simplest calculation by hand to the most advanced application of historical rain events as input to the most complicated computer programs. The simplest method is the traditional use of intensity-duration-frequency curves and the rational method. This is equivalent to running a time-area method with a straight time-area curve through all the rain events of a historical rain series. The form factor is used to multiply the flow obtained from the rational method. The use of the rational method with a form factor between 1.0-1.4 is recommended, depending on an estimated shape of the time-area curve. From that basis there are stages of increasing sophistication; the utopian approach is to run all recorded rain events of a rain series through the best available computer programs with very accurate data for the catchment under consideration. The best available programs involve a continuous hydrological simulation model and a model based on the dynamic wave theory for pipe flow. The choice of method depends on the level of ambition and the accuracy of the basic input data for the catchment in question. (Collier-IVI) W85-01694

RAINFALL DATA FOR THE DESIGN OF DE-TENTION BASINS

VIAK Consultants, Linkoeping (Sweden). V. Arnell.

Water Science and Technology, Vol. 16, No. 8/9, p 255-270, 1984. 7 Fig, 6 Tab, 13 Ref.

Descriptors: *Detention reservoirs, *Urban runoff, *Storm runoff, *Storm water, *Rainfall distribu-tion, *Hydraulic design, Design storms, Storms, Mathematical analysis, Model studies, Rainfall-runoff relationships.

This paper describes the selection of rainfall data for design of detention basins. The use of design storms (the uniform intensity design storm, the Chicago design storm and the Sifalda design Chicago design storm and the Sifalida design storm) was compared with the use of historical storms where the historical storms were assumed to give the most correct result. Historical storms were selected from an 18-year rainfall record; local coefficients were estimated from the same record. Three test catchments were used and detention basins were located at the outlet of each basin. For the runoff simulations, the CTH-Urban Runoff Model was used which also included a detention basin submodel. The results show the importance of design storms having total volumes that correspond to the volumes of historical storms. Use of the uniform intensity design storm and the Chicago design storm resulted in underestimated detention basin volumes. The Sifalida design storm caused overestimated basin volumes which can be reduced after an improvement of the storm. (Author's abstract) stract)

INFLUENCE OF RAINFALL CHARACTERISTICS ON THE POLLUTION EMISSION, DHV Consulting Engineers, Amersfoort (Nether-

K. Bakker, and H. S. J. van Wieringen

Water Science and Technology, Vol. 16, No. 8/9, p 285-295, 1984. 3 Fig, 3 Tab, 6 Ref.

Descriptors: *Water pollution sources, *Storm wastewater, *Rainfall impact, *Combined sewers, Combined sewer overflows, Storm runoff, Sewers, Storage reservoirs, Runoff coefficient, Overflow, Urban hydrology, Urban runoff, Biological oxygen demand, Chemical oxygen demand, Suspended

An extensive data collection program has been implemented in the Netherlands which provides data on quantities and qualities of stormwater discharges from sewer systems into surface water. To protect the quality of surface waters the combined sewer system is designed to act as a storage reservoir; overflows are restricted by enlarging the storage capacity of individual sewers which is accomplished by overdimensioning of individual sewers. Virtually all sewers in the Netherlands are situated below the level of the overflow weir. Each catchment studied is equipped with continuously recording rain and water level gauges. The measurements started in 1981 at the combined sewer system of Loenen and were later started at other locations. Run-off coefficients were derived from water balances for various storms and show a distinct seasonal influence. In winter time, the coefficients related to impervious area appear to be higher than 1.0. During summer, coefficients considerably below 1.0 have been found. The emission of suspended solids appears to depend on rainfall sacrapty below 1.0 have been round. In emission of suspended solids appears to depend on rainfall characteristics. The time of filling of the sewer system reflects these characteristics and appears to be decisive for the concentrations of the suspended solids at the beginning of an overflow. The same holds true for BOD and COD. Long filling times notes true for BOD and COD. Long nining times result in much lower concentrations as compared to short filling times. Suspended solids concentrations during an overflow could be predicted by taking into account the washout of the pollutants and the discharge at the overflow weir. (Collier-W85-01697

OVERFLOW DATA OF RAINWATER DIS-CHARGE SYSTEMS DETERMINED FROM RUN OFF SIMULATION OF PLUVIOGRAPH

Lautrich and Pecher, Dusseldorf (Germany, F.R.). R. Pecher.

Water Science and Technology, Vol. 16, No. 8/9, p 297-309, 1984. 9 Fig, 4 Tab, 8 Ref.

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Overflow, *Pluviographs, *Runoff sim-ulation, Simulation, Sewer systems, Combined sewers, Statistical analysis.

Group 2E-Streamflow and Runoff

In the last years, the relieving activity of overflow structures in combined sewer systems was mainly determined by statistical analysis of rainfall data. Due to the rain lost on the surface of a drainage area and to the flow retardation through the sewer network, the resulting runoff variation differs a lot from the rainfall variation. Therefore, the rainfall measurements of 4 rain gaging stations in Hamburg with a total of 67 recorded years and a rain gaging station in Berlin with 22 recorded years were used to carry out runoff simulations. A rainfall statistical analysis was performed with the measured rainfall data in order to determine the annual rainfall durations, depths and frequencies in relation to the average rain intensity. The annual overflow data from overflow structures (overflow weirs and overflow basins) of nonprerelieved drainage areas were computed by means of a simplified runoff model. The so determined overflow data was considerably lower than the data of rainfall analysis. Overflow data from overflow structures in combined sewer systems would not be satisfying if they are derived from only statistical rainfall analysis. Recorded rainfall events should rather be transformed into runoff events and accordingly analyzed. As there were only 3 rain gaging stations available, a generalization of the computed overflow data is still impossible. However, these overflow data seem to be plausible on the whole if compared with rainfall data which were collected in the past only during the summer months. (Author's abstract) in the past only during the summer months. (Author's abstract) thor's abstr W85-01698

METHODS FOR CALCULATION OF ANNUAL AND EXTREME OVERFLOW EVENTS FROM COMBINED SEWER SYSTEMS,

Technical Univ. of Denmark, Lyngby. Dept. of

Recimical Univ. of Estimate Systems of Sanitary Engineering.

N. B. Johansen, P. Harremoes, and M. Jensen.

Water Science and Technology, Vol. 16, No. 8/9, p 311-325, 1984. 9 Fig. 4 Tab, 14 Ref.

Descriptors: *Urban runoff, *Overflow, *Combined sewer systems, *Rainfall-runoff relationships, Water pollution sources, Statistical analysis, Urban hydrology.

Overflow from combined systems constitute an coversion from combined systems constitute an increasing source of pollution of receiving waters, as compared to daily wastewater discharges which undergo treatment to a still higher extent. The receiving water problems from overflows are significant both in a long term scale (mean annual load) and in a short term scale (extreme event load) and in a short term scale (extreme event load). A method for computation of both annual and extreme load was developed based on historical rain series and the use of a time-area model and simple pollutant mixing model in runoff calculation. Statistical calculations for both mean annual load and extreme events have been applied to the computed overflow series. Based on the computerized method simple manual calculation methods have been developed, resulting in graphs and tables for annual load and extreme load. (Author's abstract) stract) W85-01699

RECONNAISSANCE OF SURFACE WATER RESOURCES IN THE TOGIAK RIVER BASIN, SOUTHWESTERN ALASKA, 1980 AND 1982, Geological Survey, Anchorage, AK. Water Re-sources Div.

For primary bibliographic entry see Field 2A. W85-01777

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982, Geological Survey, Helena, MT. Water Resources

Div.
R. J. Omang.
R. J. Omang.
Available from OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 84-4063, 1984. 78 p, 1 Fig. 71

Descriptors: *Low flow, *Flood frequency, *Flow duration, Gaging stations, Streams discharge, Yel-lowstone River basin, *Montana.

Statistical summaries of streamflow data for selected stream-gaging sites are presented in this report to aid in appraising streamflow in the Yellowstone River basin. Streamflow records are presented for 71 gaging stations for the period of record. Streamflow record collection in the Yellowstone River basin began in 1889. For each gaging station selected for this report, a brief description is given for station location, drainage area, period of record, revisions of previously published records, type and history of gages, regulation and diversions, average discharge, and extremes of discharge. This information is followed by tables of monthly and annual flow statistics, flood-frequency data, low-flow and high-flow frequency data, and flow-duration data. (USGS) high-flow f (USGS) W85-01781

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RE-SERVES IN EASTERN KANSAS,

Geological Survey, Lawrence, KS. Water Re-

Geological Survey,
Sources Div.
H. E. Bevans.
Available from OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 84-4047, 1984. 30 p, 12 Fig, 6

Descriptors: "Water quality, "Streamflow, "Coal mining, Dissolved solids, Sulfate, Suspended sediment, Flow duration, Storm runoff, Detention reservoirs, "Coal hydrology, "Kansas, Marais des Cygnes River, Little Osage River, Linn County, Miami County, Bourbon County, Mulberry Coal.

The U.S. Geological Survey investigated the hydrologic responses of streams with respect to coalmining activities in the Mulberry coal reserves of Miami, Linn, and Bourbon Counties, eastern Kansas. Results of a low-flow water-quality reconaissance showed that small streams draining previously coal-mined areas generally have relatively large concentrations of sulfate. Large streams in the study area have been relatively unaffected by coal mining. A comparison of two small drainage basins showed that the basin affected by an active strip mine had less high flow and more low flow because of the regulating effects of sediment ponds. Effluent pumped from the strip mine increased the load of sulfate by 244 percent, the load of dissolved solids by 41 percent, and occasionally transported relatively large concentrations of iron, lead, manganese, and zine to the receiving stream. Accelerated erosion caused by the exposure and disturbance of soil during clearing and excavation increased the sediment load of the receiving stream by 25 percent even though sediment ponds were installed. (USGS) The U.S. Geological Survey investigated the hy-W85-01782

EFFECIS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA, Ceological Survey, Doraville, GA. Water Re-

sources Div R. F. Carter.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4158, 1983. 46 p, 23 Fig, 3 Tab. 8 Ref.

Descriptors: *Low flow, *Flow frequency, *Ground-water levels, Reservoir stages, *Streamflow, *Groundwater, Water resources, *Georgia.

The 1980-81 drought resulted in the lowest rates of streamflow since 1954 in most areas of Georgia, streamflow since 1954 in most areas of Georgia, and the lowest since 1925 in some areas. Over most of the State, minimum average streamflows for periods of 1, 7, 30, 60, 90, and 183 consecutive days receded to low levels estimated to be reached at average intervals of 10 to 25 years. Flows in the Fliat River from central to southwest Georgia receded to levels estimated to be reached at average intervals of 70 years. Pool levels at four major receptivity receded to the lowest leads since the age intervals of 10 years. Pool levels at four major reservoirs receded to the lowest levels since the reservoirs were first filled. Ground-water levels declined below the lowest levels previously ob-served in many observation wells. Nearly continu-ous declines were recorded in some wells for as much as 20 consecutive months, and levels remained below the previous minimum level of record for as much as 9 consecutive months. W85-01783

PREDICTION OF PEAK FLOWS FOR CUL-VERT DESIGN ON SMALL WATERSHEDS IN

OREGON, Oregon State Univ., Corvallis. School of Forestry. For primary bibliographic entry see Field 4A W85-01820

DAILY WATER AND SEDIMENT DIS-CHARGES FROM SELECTED RIVERS OF THE EASTERN UNITED STATES: A TIME-SERIES MODELING APPROACH, Geological Survey, Lakewood, CO. Water Re-sources Div.

For primary bibliographic entry see Field 2J. W85-01823

WATER RESOURCES DATA, KENTUCKY, WATER YEAR 1982.

Geological Survey, Louisville, KY. Water Resources Div. J. M. Bettandorff, J. N. Sullavan, D. W. Leist, and D. V. Whitesides.

D. V. Whitesides. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-162320. USGS Water-Data Report KY-82-1, (May, 1983). 517 p. Prepared in cooperation with the state of Kentucky and with other agencies.

Descriptors: *Kentucky, *Hydrologic data, *Surface waters, *Water quality, *Groundwater, Gaging stations, Streamflow, Flow rates, Lakes, Wells, Chemical analyses, Suspended sediments, Water temperature, Water levels, *Data collections.

Water resources data for the 1982 water year for Kentucky consist of records of stage, discharge, and water quality of streams; stage and contents of lakes; and water levels and water quality of wells and springs. This report contains discharge records from 115 gaging stations; stage and contents for 15 lakes; suspended-sediment data for 38 stations (12 daily); daily temperature records for 26 stations; daily specific conductance for 14 stations; ground-water level for 75 recording; 99-partial sites; water-quality data from 24 stations sampled at regular intervals and 70 wells; and miscellaneous temperature and specific conductance from the 115 gaging stations. Also included are data for 118 partial-record crest-stage sites. Data collected at various miscellaneous sites is also published. (USGS) W85-01923 W85-01923

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW MEXICO, 1982, Geological Survey, Albuquerque, NM. Water Resources Div.

R. R. Cruz

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-695, 1983. 32 p, 13 Fig, 7 Tab, 5 Ref.

Descriptors: *Hydrologic data, *Groundwater, Potentiometric level, *Water quality, *Slope-area measurement, Peak flow, *New Mexico, Military installation, White Sands Missile Range.

Ground-water data were collected in 1982 at White Sands Missile Range in south-central New Mexico. Depth-to-water measurements in the Post Headquarters supply wells continued to show seasonal declines. Test wells east of the Headquarters well field continue to show long-term declines as well as seasonal fluctuations. The total amount of water pumped from White Sands Missile Range supply wells was 66,226,600 gallons more in 1982 than in 1981. The difference in the specific-conductance values of the water samples collected from the Post Headquarters supply wells in the winter and summer increased in 1982. (USGS) W85-01927

WATER RESOURCES DATA, IOWA, WATER

WATER RESOURCES DATA, IOWA, WATER YEAR 1982, Geological Survey, Iowa City, IA. Water Resources Div. I. Burmeister, V. L. Spiers, P. J. Soenksen, and W. J. Matthes, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-137215. USGS Water-Data Report IA-82-1, 1983. 262 p, 10 Fig. 2 Tab. Prepared in cooperation with the State of Iowa and other agencies.

Descriptors: *Iowa, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rates, Streamflow, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperature, Sampling sites, Water levels, Water analyses, *Data collections, Water wells.

Water resources data for the 1982 water year for Iowa consists of records of stage, discharge, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 116 gaging stations; stage contents for 7 lakes and reservoirs; water quality for 17 gaging stations; and water levels for 34 observations wells. Also included are 125 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. (USGS) W85-01931

WATER RESOURCES DATA, KANSAS WATER

WATER RESOURCES DATA, RAISONS WATER YEAR 1982,
Geological Survey, Lawrence, KS. Water Resources Div.
C. O. Geiger, D. L. Lacock, L. R. Shelton, M. L. Penny, and C. E. Merry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-84128396.
USGS Water-Data Report KS-82-1, 1983. 485 p, 8
Fig. 6 Tab. Prepared in cooperation with the State of Kansas and with other agencies.

Descriptors: *Kansas, Hydrologic data, Surface water, Groundwater, Water quality, Flow rates, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperature, Water level, Water analysis, *Data collections, Sampling sites.

Water resources data for the 1982 water year for Kansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and miscellaneous water quality in wells. This report contains discharge records for 145 gaging stations; stage and contents for 24 lakes and reservoirs; water quality for 58 gaging stations; and water levels for 475 observation wells and miscellaneous water quality for 96 wells. Also included are data for 91 crest-stage partial-record stations. (USGS) (USGS) W85-01932

WATER RESOURCES DATA, NEW HAMP-SHIRE AND VERMONT, WATER YEAR 1982, Geological Survey, Boston, MA. Water Resources

Div. F. E. Blackey, J. E. Cotton, and K. W. Toppin. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-161868. USGS Water-Data Report NH-VT-82-1, 1983. 145 p, 3 Fig. Prepared in cooperation with the States of New Hampshire and Vermont and with other

Descriptors: *New Hampshire, *Vermont, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for New Hampshire and Vermont consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains dis-charge records for 73 gaging stations, stage

records for 4 lakes, month end contents for 25 lakes and reservoirs, water-quality data for 4 gaging stations, and water levels for 30 observation wells. Also included are data for 3 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. Locations of gaging stations, partial-record stations, and observation wells are shown in figure 1. A few pertinent stations (not included above) in bordering States and Province of Quebec are also included in this report. (USGS) W83-01933

WATER RESOURCES DATA, ARKANSAS, WATER YEAR 1982, Geological Survey, Little Rock, AR. Water Re-sources Div.

sources Div.
T. E. Lamb. J. E. Porter, B. F. Lambert, and J.

Edds. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-181296. USGS Water-Data Report AR-82-1, 1983, 503 p, 5 Fig, 3 Tab. Prepared in cooperation with the State of Arkansas and with other agencies.

Descriptors: *Arkansas, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Arkansas consist of records of gage height, discharge, and water quality of streams; elevation, contents, and water quality of lakes; water levels and water quality of observation wells. This report contains discharge records for 55 gaging stations; water quality for 149 stations, 47 partial-record stations, 25 observation wells; and water levels for 95 observation wells. Also included are data for 99 contractions a partial record stations. 95 observation wells. Also included are class to 199 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. (USGS) published W85-01934

WATER RESOURCES DATA, MASSACHU-SETTS AND RHODE ISLAND, WATER YEAR

Geological Survey, Boston, MA. Water Resources

DIV.
R. A. Gadoury, G. G. Girouard, and D. F. Letty.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-180009.
USGS Water-Data Report MA-RI-82-1, 1984. 237
p, 5 Fig. 1 Tab. Prepared in cooperation with the
States of Massachusetts and Rhode Island and with

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water-resources data for the 1982 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 97 gaging stations, month end contents for 30 lakes and reservoirs, water quality for 10 gaging stations, and water levels for 107 observation wells. Also included are data for 3 low-flow and 18 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. (USGS)

RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1982, Geological Survey, Bismarck, ND. Water Re-

Geological Survey, Banacas, sources Div.
R. E. Harkness, and N. D. Haffield.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-136589.

Streamflow and Runoff-Group 2E

USGS Water-Data Report ND-82-1, 1983. 418 p, 18 Fig. 2 Tab. Prepared in cooperation with the State of North Dakota and with other agencies.

Descriptors: *North Dakota, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water tempera-tures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for North Dakota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 110 gaging stations; stage only records for 21 gaging stations; stage and contents for 12 lakes and reservoirs; water quality for 114 gaging stations? Islaes, 67 wells, and water levels for 31 observation wells. Additional water data were collected at various sites, not involved in the systematic data collection program, and are published as miscellaneous measurements. (USGS)

WATER RESOURCES DATA, SOUTH CAROLI-

NA, WATER YEAR 1982, Geological Survey, Columbia, SC. Water Resources Div.

sources Div.

C. S. Bennett, R. D. Hayes, J. W. Gissendanner, and H. E. Herlong.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-84162577.

USGS Water-Data Report SC-82-1, 1983. 330 p, 5 Fig. Prepared in cooperation with the State of South Carolina and with other agencies.

Descriptors: *South Carolina, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for South Carolina consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of streams; stage, contents, and water quality of ground-water wells. This volume contains records for water discharge at 78 gaging stations, stage and contents at 11 lakes and reservoirs, water quality at 37 gaging stations, and water levels at 57 observation wells. Also included are data for 42 crest-stage partial-record stations. Locations of these sites are shown on figures 3, 4, and 5. Additional water data were collected at various sites not involved in the systematic data-collection program. (USGS)

WATER RESOURCES DATA, GEORGIA, WATER YEAR 1982, Geological Survey, Doraville, GA. Water Re-sources Div.

W. R. Stokes, III, T. W. Hale, J. L. Pearman, and G. R. Buell.

G. R. Buell.

Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-128412.
USGS Water-Data Report GA-82-1, 1983. 390 p, 8
Fig. 1 Tab. Prepared in cooperation with the State
of Georgia and with other Federal agencies.

Descriptors: *Georgia, *Hydrologic data, *Surface water, *Water quality, *Groundwater, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Wells, Sediments, Water temperatures, Sam-pling sites, Water levels, Water analyses, *Data collections.

Water resources data for the 1982 water year for Georgia consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records of 109 gaging stations; stage for 10 gaging stations; stage and contents for 17 lakes and reservoirs; water quality for 17 continuous stations, 115 periodic stations

Field 2-WATER CYCLE

Group 2E-Streamflow and Runoff

and miscellaneous sites; peak stage and discharge only for 109 crest-stage partial-record stations and 20 miscellaneous sites; measurements of discharge at 49 low-flow partial-record stations and 15 mis-cellaneous sites; and water levels of 28 observation wells. (USGS) W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982, Geological Survey, Tuscaloosa, AL. Water Re-sources Div. H. C. Rollins, F. C. Sedberry, E. G. Ming, and I.

H. C. Rollins, F. C. Sedderry, E. U. Mang, and E. A. Giles.
A vailable from the National Technical Information Service, Springfield, VA 22161 as PB84-183250.
USGS Water-Data Report AL-82-1, 1983. 467 p, 7 Fig. 1 Tab. Prepared in cooperation with the Geological Survey of Alabama, the Alabama Highway Department, and with other State, Municipal, and Federal agencies.

Descriptors: *Alabama, *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservors, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses, *Data collec-

Water resources for the 1982 water year for Alabama consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 85 gaging stations; stage only for 16 gaging stations, stage and contents for 12 lakes and reservoirs; water quality for 67 gaging stations and 76 wells, and water levels for 52 observation wells. Also included are 10 creat-stage partial-record stations, 8 flood hydrograph partial-record stations and 91 water-quality partial record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. (USGS) systematic data-contections lished as miscellaneous men (USGS) W85-01939

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS, Geological Survey, Lawrence, KS. Water Resources Div.

For primary bibliographic entry see Field 2A. W85-01949

INTEGRATED METHODOLOGY FOR IN-STREAM FLOW STRATEGIES, Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 5B. W85-01951

FORECASTING OF WATER LEVEL AND DIS-CHARGE OF THE ELBE WITH THE AID OF FUZZY MODELLING (VORHERSAGE VON WASSERSTAND UND DURCHFLUSS FUR DIE ELBE MIT HILFE EINER UNSCHARFEN MO-

DELLIERUNG), Technische Univ., Dresden (German D.R.). Ber-

eich Hydrotnosogse. N. Hansel, R. Oppermann, and B. Straube. Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 67-69, February, 1983. 6 Fig. 5 Tab, 8 Ref.

Descriptors: *Flow discharge, *Water level, *Forecasting, *Fuzzy modeling, *Elbe, *East Germany, Model studies, Computers, Hydrologic models.

Fuzzy modelling has proven to be an effective method of forecasting the water level (W) and discharge (Q) of large rivers because it allows a description of the river as a whole, set-up of the model using relatively few data, consideration of new observations, direct utilization of experiences of professionals in the subject field, and inclusion of information gathered after the model has been set in motion. A fuzzy model was used to predict W and Q for the East German portion of the Elbe river together with its main tributaries, Mulde and

Saale. Input data were taken from measurements made at three gauges (one on each river) in the 1960s and 70s, and model results were compared with the actual situation. The model consists principally of five fuzzy relationships, R1-5. R1 is a fuzzy classifier representing the relationship between the progress line measured at gauge 1 and a set of hydrologically meaningful patterns. The dynamic situation at gauge 1 is represented by the values X1-3, R2 and R3 are constructed similarly for gauges 2 and 3. R4 classifies the situation at the forecast gauge (X10) at a point in time t1 into 'high' or 'low.' R5 represents the relationship between T1-3, the water-level set H (resulting from R4), and the predicted-value set, Y. The model was found to be highly accurate, and it will be possible to improve it further with practical experience. The model can be expanded at the X1-10 level to include previously measured values or those collected at smaller time intervals. The model is programmed in FORTRAN and was run on an SM4 minicomputer. (Gish-IVI)

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIB-UTARIES, NEVADA TEST SITE, SOUTHERN NEVADA, Geological Survey, Carson City, NV. Water Resources Div.

Sources Liv.

R. R. Squires, and R. L. Young.

Available from the OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225, USGS Water-Resources
Investigations Report 83-4001. 33 p, 23 Fig. 5 Tab,

12 Ref.

Descriptors: "Flood frequency, "Regional floods, Flood channels, "Flood discharge, Flood plains, Flood recurrence interval, Roughness coefficient, Regression analysis, Fortymile Wash, "Nevada, "Nevada Test Site, 100-year flood, 500-year flood, Busted Butte Wash, Drill Hole Wash, Yucca Wash.

Analysis of flood hazards for a 9-mile reach of Analysis of 1000 alexaus for a 9-mile reach of Portymile Wash and three of its tributaries was undertaken to aid in determining possible sites for the storage of radioactive wastes. Data from 12 peak-flow gaging stations adjacent to the Test Site were used to develop regression relations that permit an estimation of the magnitude of the 100-eat 500. permit an estimation of the magnitude of the 100-and 500-year flood peaks. The regional maximum flood was estimated on the basis of data from extreme floods elsewhere in Nevada and in sur-rounding states. On Fortymile Wash (drainage area rounting states. Or Fortymine wash (graning area at farthest downstreams cross section, 312 sq mi), the estimated maximum water depth for the three flood magnitudes are 8, 11, and 29 feet, respectively. Mean flow velocities would be as great as 9, 14,

ESTIMATION OF NATURAL STREAMFLOW IN THE JEMEZ RIVER AT THE BOUND-ARIES OF INDIAN LANDS, CENTRAL NEW MEXICO, Geological Survey, Albuquerque, NM. Water Re-

Geologicai Survey, Albuquerque, NM. Water Resources Div. E. E. Fischer, and J. P. Borland. Available from OFSS, USGS, Box 25425, Fed. Ctr. Deaver, CO 80225. USGS Water-Resources Investigations Report 82-4113, 1983. 27 p, 3 Fig. 9 Tab, 17 Ref.

Descriptors: Streamflow, Reservoirs, Hydraulic characteristics, Water losses, Streamflow routing, *Indian lands, Surface water, Streamflow records, Trans-basin diversion, Irrigation diversion, Jemez River, *New Mexico, Sandoval County.

Natural streamflow in the Jemez River at the boundaries of Indian lands was estimated from available streamflow records which were adjusted by estimated losses of water due to man-made changes in the hydraulic characteristics of the river basin. The average estimate annual natural streamflow is 53,180 acre-feet at the upstreams boundary of the Jemez Indian Reservation, 53,180 acre-feet at the Jia-Santa Ana Indian Reservation boundary, 55,440 acre-feet at the Zia-Santa Ana Indian Reservation boundary, and 46,550 acre-feet

at the downstream boundary of the Santa Ana Reservation. (USGS) W85-02048

FLOODS OF AUGUST 7-8, 1979, IN CHAUTAU-QUA COUNTY, NEW YORK, WITH HYDRAU-LIC ANALYSIS OF CANADAWAY CREEK IN THE VILLAGE OF FREDONIA, Geological Survey, Albany, NY. Water Resources

Div.
R. Lumia, and W. H. Johnston.
Available from the OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4211, 1984. 16 p, 8 Fig, 3
Tab, 17 Ref.

Descriptors: *Floods, *Flood profiles, *Flood peak, *Water-surface profiles, Rainfall intensity, Flood-frequency, Indirect flood measurement, *New York, Rainfall frequency, Debris jam, Chautauqua county, Fredonia

Extensive flooding of streams in Chautauqua County, N.Y., on August 7-8, 1979, after severe thunderstorms, resulted in one death and millions of dollars worth of property damage. Severe flooding was reported on Canadaway Creek in Fredomia, where the peak discharge was computed to be 12,000 cubic feet per second. The recurrence interval of this discharge is estimated to be greater than 100 years (exceedance probability less than 0.01). A hydraulic analysis of the flood in Fredonia indicated that a debris iam at the Water Street bridge cated that a debris jam at the Water Street bridge caused the water level (as determined from floodcaused the water level (as determined from flood-marks) immediately upstream from the bridge to be 2.9 feet higher than level computed for unobstruct-ed (without debris) flow conditions. The 100-year flood discharge at the Water Street bridge is com-puted to be 5,280 cubic feet per second, and the corresponding water level just upstream from the bridge (under unobstructed flow conditions) is 5.9 feet lower than the level observed during the August 7-8, 1979 flood. (USGS) W85-02051

COMPUTATION OF CONTINUOUS STREAM-FLOW RECORDS,

Geological Survey, Reston, VA. Water Resources

E. J. Kennedy. Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Techniques of Water-Resources Investigations (Book 3, Chapter A-13), 1983. 53 p, 34 Fig. 5 Ref.

Descriptors: *Hydrometry, *Stream gages, *Hydrologic data collections, Channel flow, Water measurement, Streamflow.

Records of continuous streamflow, published in the U.S. Geological Survey annual Water Data Reports for the States and territories, are computed from field data, mainly discharge measurements and recorder charts or tapes. This manual describes the computation procedures used and some details of related field operations. It was compiled mostly from unpublished Water Resource Division district manuals edited and supplemented to emphasize digital-recorder and associated computer use. Methods used primarily for graphic-recorder gaging stations and non-recording gages are also included. Reference is made to other publications for some of the more specialized or unusually complex procedures. (USGS)

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH SYSTEMS,

Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.

E. Jeppesen. Hydrobiologia, Vol. 91, p 189-195, July, 1982. 4 Fig. 15 Ref. Danish Research Foundation grant

Descriptors: *Susaa River, *Denmark, *Sediment-water interface, *Oxygen uptake, *Fluvial sedi-

Streamflow and Runoff-Group 2E

ments, *Measuring instruments, Water tempera-ture. Exchange rate, Aerobic conditions.

ments, "Measuring instruments, Water temperature, Exchange rate, Aerobic conditions.

Various incubation methods have been used for the measurement of oxygen exchange over the sediment-water surface in lotic environments. In Danish river systems the diurnal variations in oxygen concentration and the temperature in the summer are often quite high (5-21 ing O2/L and 5-8 C) and the sediment is very beterogenous. These conditions must be considered when designing an incubation system. The diurnal exchange of oxygen, over the sediment-water interface, was measured on 'undisturbed' sediment cores incubated on the river bank of three reaches in the river Susaa, Denmark. The incubation chambers were equipped with a double pumping system, driving an internal and an external flow, respectively. The internal flow created a unidirectional flow over the sediment surface, with the same velocity as the natural river flow. River water was pumped through the incubation chambers (external flow) and through a registration chamber equipped with an oxygen probe and a temperature transducer. Various methods were used for the numerical solution of the differential equation which describes the rate of exchange rate and the oxygen exchange rate such the oxygen exchange rate and the oxygen concentration. A minimum in the exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rates were lower in periods with increasing oxygen concentration. A minimum in the exchange rate was obtained before the minimum in the concentration of oxygen and temperature was found. This type of hysteresis could be explained by equilibration in connection with the transient state conditions. The hysteresis was probably enlarged by shifts in the

ANALYSIS OF TOTAL PHOSPHORUS TRANS-

PORT IN RIVER SYSTEMS,
West Virginia Univ., Morgantown.
F. H. Verhoff, D. A. Melfi, and S. M. Yaksich.
Hydrobiologia, Vol. 91, p 241-252, July, 1982. 11

Descriptors: *Phosphorus, *Solute transport, *Path of pollutants, Sediment transport, Storm water, Nutrient transport, Nitrogen.

water, Nutrient transport, Nitrogen.

Human activities generate many pollutants from different land uses. These pollutants include nutrients (e.g., phosphorus and nitrogen), toxic substances (e.g., the lord of the substances (e.g., chlorides and salts). These materials often enter a river at some upstream point and are transported downstream by the flowing water. Many substances are transported both during storms and during normal river flow and often the major portion of the transport occurs during the storm. This paper considers the quantification of transport primarily during storms. First, the characteristics of storm transport are discussed. Then, a calculation method for estimating the distance of travel for sediment related materials is presented. Third, a technique to estimate the amount of a given chemical passing a point in a stream over a specified period of time is presented. The last part of this paper contains a technique for tracing the movement of substances through a river network. In particular, this procedure yields information as to the source of given pollutants over the entire storm period. (Author's abstract) W85-02074

INFLUENCE OF WITHIN-STREAM DISTURB-ANCE ON DISSOLVED NUTRIENT LEVELS DURING SPATES,

Freshwater Biological Association. Wareham

Freshwater Biological Association, Wareham (England), River Lab. H. Casey, and I. S. Farr. Hydrobiologia, Vol. 92, p 447-462, July, 1982. 8 Fig. 1 Tab, 31 Ref. Department of the Environment contract DGR 480/309.

Descriptors: *Dissolved nutrients, *Spates, *Freshets, *Nutrients, Streams, Organic carbon, Phosphates, Silicates, Nitrates, Potassium, Suspended solids, Bacteria, Organic matter.

In rivers, variations in concentrations of many dissolved nutrients occur during spates. Increases are usually attributed to concentrated point or non-point inputs, and decreases to dilution associated with rainfall. Increased discharge disturbs sediments and benthic communities, but the effects of such disturbance on nutrient levels are difficult to isolate. Measurements of nutrient levels over three artificial spates revealed that substantial variations in dissolved organic carbon, dissolved phosphate, silicate, nitrate, and potassium levels could result from increased discharge in the absence of allochthonous inputs. Variations were closely related to peaks in suspended solids concentration or water height. Increases in biochemical oxygen demand and suspended bacteria also occurred. Variations in phosphate and silicate could be accounted for by a balance between release of 'sediment interstitial water' and exchange processes involving suspended and freshly exposed sediment. An increase in nitrate, during one spate, was due to a reduction in the effect of benthic denitrification. Small peaks in dissolved organic matter concentration were detected over each spate. We propose that within-stream disturbance is a factor which may contribute to variations in dissolved nutrient concentration during the rising hydrograph in natural spates. (Author's abstract)

AVAILABILITY OF DISSOLVED OXYGEN IN INTERSTITIAL WATERS OF A SANDY

CREEK,
Indiana Univ. Northwest, Gary.
R. L. Whitman, and W. J. Clark.
Hydrobiologia, Vol. 92, p 651-658, July, 1982. 6
Fig. 1 Tab, 19 Ref.

Descriptors: *Interstitial water, *Dissolved oxygen, *Streams, *Mill Creek, *Texas, Conductivity, Alkalinity, Storm runoff, Convection, Base flow, Mixing, Thermal properties.

The chemical makeup of interstitial water is due to the combined influences of groundwater and surface waters. The possibility is examined of a thermally induced exchange mechanism for mixing of surface and subsurface waters in small, clean, sandy streams which display marked diurnal temperature fluctuations. Dissolved oxygen, pH, conductivity and alkalinity of surface and subsurface interstitial waters were investigated at Mill Creek (a small, rural, predominantly sandy stream in east Texas). Dissolved oxygen concentration tended to decrease with sediment depth, while conductivity and alkalinity did not significantly change with substrate depth. Surface water pH was significantly higher than interstitial water (p = 0.05). Chemical analyses of subsurface water from a preto post-storm event showed a depression in dissolved oxygen concentration in moderate and deep interstitial waters, immediately following the return of stream base flow, with the deeper strata returning to pre-storm oxygen levels four days later. A thermal convective current mechanism is proposed which would serve to transport surface water downward into these deeper interstices. The convective mechanism could influence the downward transport of organic material by helping to keep it in suspension. (Moore-IVI)

TWO-COMPONENT EXTREME VALUE DISTRIBUTION FOR FLOOD FREQUENCY

ANALYSIS, Naples Univ. (Italy). Dept. of Hydraulic Construc-

F. Rossi, M. Fiorentino, and P. Versace. Water Resources Research, Vol. 20, No. 7, p 847-856, July, 1984. 7 Fig, 1 Tab, 44 Ref.

Descriptors: *Flood frequency, *Italy, *Two-com-ponent extreme value, Statistical analysis, Tempo-ral distribution, Statistical models.

Theoretical considerations, supported by statistical analysis of 39 annual flood series (AFS) of Italian basins, suggest that the two-component extreme value (TCEV) distribution can be assumed as a parent flood distribution, i.e., one closely representative of the real flood experience. This distri-

bution belongs to the family of distributions of the annual maximum of a compound Poisson process, which is a solid theoretical basis for AFS analysis. However, the two-parameter distribution of this family, obtained on the assumption of identically distributed floods, does not account for the high variability of both observed skewness and largest order statistics, so that a significant number of observed floods qualify as outliers under this distribution. The more general TCEV distribution assumes individual floods to arise from a mixture of two exponential components. Its four parameters can be estimated by the maximum likelihood method. A regionalized TCEV distribution, with parameters representative of a set of 39 Italian AFS's, was shown to closely reproduce the observed distribution of skewness and that of the largest order statistic. (Author's abstract) bution belongs to the family of distributions of the

MAXIMUM LIKELIHOOD ESTIMATES FOR THE PARAMETERS OF MIXTURE DISTRIBU-

TIONS, Washington Univ., Seattle. Dept. of Civil Engi-

K. M. Leytham. Water Resources Research, Vol. 20, No. 7, p 896-902, July, 1984. 1 Fig. 5 Tab, 17 Ref. OWRT projects A-107-WASH and A-115-WASH.

Descriptors: *Estimating, *Water resources development, Floods, Streamflow, Monte Carlo method, Mathematical studies, Model studies, Mix-

Maximum likelihood estimates (MLEs) for the parameters of a mixture of two normal ditributions rameters of a mixture of two normal ditributions are presented in terms of an expectation-maximization (EM) algorithm. Small sample properties of the parameter estimates are explored using Monte Carlo simulation. The EM algorithm has a number of attractive features. The algorithm is guaranteed to converge to a local if not a global maximum. Every iteration of the algorithm is guaranteed to increase the log likelihood. The iterative estimates always yield valid parameter values, that is, positive variance and mixing proportion between zero and one. Potential problems in the use of MLE's include the following. There may be singularities and one. Potential problems in the use of MLE's include the following. There may be singularities on the likelihood surface. In some situations the iterative algorithm will converge to parameter values associated with a singularity. Like all other currently available estimation procedures, the EM algorithm does not guarantee convergence to a global maximum. A global maximum can only be ensured by an exhaustive search of the mutidimensional likelihood surface. Little is known about the small-sample properties of the MLE's. Since hydrometeorologic records are generally less than 50 years in length, the small sample properties of estimators are of concern. Although parameters estimated from unclassified data are maccurate, quantiles derived from the fitted distributions are only slightly less accurate than quantiles estimated quanties derived from the inter distributions are only slightly less accurate than quantiles estimated from classified data. This suggests that the ability to classify a sample may not be crucial for the wide range of problems in which quantiles are of princi-pal concern. (Baker-IVI) W85-02156

OBJECTIVE IDENTIFICATION OF POOLS

State Univ. of New York at Buffalo. Dept. of Geography.
M. P. O'Neill, and A. D. Abrahams

Water Resources Research, Vol. 20, No. 7, p 921-926, July, 1984. 8 Fig, 18 Ref.

Descriptors: *Pools, *Riffles, *Alluvial streams, Bed forms, Bed elevation, Mathematical studies, Channels, Dunes.

Alternating pools (deeps) and rifles (shallows) have come to be recognized as a fundamental morpho-logical characteristic of alluvial stream channels. A rogical characteristic of aniuvina stream channels. A new technique for objectively identifying pools and riffles is termed the bed form differencing technique. It has as its data base bed elevations surveyed at a fixed interval along the channel. Elevations are differenced, and the difference or

Group 2E-Streamflow and Runoff

elevation change values are used to identify pools and riffles. Where the cumulative elevation change since the last bed form exceeds a certain tolerance value, a new bed form is considered to exist, the type of bed form being determined by the direction of the elevation change. The channel reach studied is located on Mannfield Creek, approximately 65 km south of Buffalo, NY. A well-developed pool-riffle sequence is evident along the full length of the reach. The most realistic pool-riffle sequence is obtained where the tolerance value is 0.75 times the standard deviation of the difference values. The bed form differencing technique can be used to identify bed forms other than pools and riffles, such as ripples and dunes, by simply modifying the surveying interval to reflect the scale of the bed forms. The technique is easy to apply insofar as the requisite data can be collected with a level, survey staff, and measuring tape, and the analysis involves only simple arithmetic. The technique produces results that are reproducible, realistic, and spatially consistent. (Moore-IVI)

ADDITIONAL TESTS ON THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK FLOW FROM WILD-LAND BASINS.

Georgia Univ., Athens. School of Forest Re-

J. D. Hewlett, J. C. Fortson, and G. B.

Cunningham. Water Resources Research, Vol. 20, No. 7, p 985-989, July, 1984. 5 Tab, 13 Ref.

Descriptors: *Rainfall intensity, *Storm runoff, *Flood peak, Drainage basins, Forest watersheds, Statistical studies, Perennial streams.

Hourly rainfall intensity has been found to have no appreciable effect on storm flows, and only a small effect on peak flows. A statistical analysis was carried out for 4094 storm events on 15 forested drainage basins ranging from 13 to 760 ha in area. The basins were in Kentucky (1), West Virginia (1), South Carolina (1), New Hampshire (1), Pennsylvania (1), Georgia (2), North Carolina (5), Arizona (1), Australia (1), and South Africa (1). The basins range from humid to semisarid climates and from flat to steep topography and contain various covers (forest, brush, grass, and swamp). About half of the basins tested showed significant response (0.05 level) to hourly rainfall intensity for both storm flow and peak flow. The marginal coefficient of determination accounted for by maximum hourly rain intensity averaged about 1% for storm flows and about 10% for peak flows. The dependence of storm flows on rain intensity did not increase in larger storms or on more responsive basins, but rather the opposite. Storm flow from wild have been seen to the form the control of the c not increase in larger storms or on more responsive basins, but rather the opposite. Storm flow from wild-land basins supplying at least first-order perennial streams is little affected by hourly rainfall intensity. In the case of peak flows from such basins, intensity is effective in boosting channel-derived peaks, particularly on low-response basins, but is not a prime determiner of peak discharges on high-response basins. (Moore-IVI) W85-02166

PHYSICALLY BASED FLOOD FREQUENCY

DISTRIBUTION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Massachus Civil Engir Civil Engineering.
M. A. Diaz-Granados, J. B. Valdes, and R. L.

Bras.
Water Resources Research, Vol. 20, No. 7, p 995-1002, July, 1984. 9 Fig. 2 Tab, 19 Ref.

Descriptors: *Flood frequency, *Frequency distri-bution, Probability distribution, Forecasting, Fre-quency analysis, Mathematical studies.

The geomorphoclimatic instantaneous unit hydrograph theory, the joint probability density function of storm duration and intensity, and Philip's representation of the infiltration process are used to derive a flood frequency distribution that could be used in regions with no streamflow records. The distribution requires storm, soil, and geomorphologic characteristics which in principle may be evaluated from climatic records, field observations,

and/or remote sensing. The model was applied to two basins, one representative of an arid climate and the other of a wet climate, with reasonable results. The resulting flood frequency distribution is in analytical form containing only few climatolo-gic and physiographic parameters of the catch-ment. (Baker-IVI) W85-02168

2F. Groundwater

CHANGE IN QUALITY OF THERMAL GROUNDWATER FROM A UNIQUE RE-SOURCE IN LEBANON, American Univ., Beirut (Lebanon). Dept. of Envi-ronmental Health.

ronmental Health.

A. Acra, R. Milki, and Y. Karahagopian.
International Journal of Environmental Studies,
Vol. 19, No. 1, p 63-68, 1982. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Lebanon, *Summaqiyeh, *Thermal water, *Groundwater, *Physicochemical charac-teristics, Water temperature, Hardness, Corrosi-

Thermal groundwaters were not known in Leba-non until 1968, when a 550 m deep artesian well was drilled into the Cenomanian limestone aquifer was drilled into the Cenomanian limestone aquifer occuring at a depth of 485 m. The well is located close to Summaqiyeh village in the morthern part of Akkar plain. The stored groundwater was intially at a temperature of about 43 c. The physicochemical quality of the water was monitored during a six year period from 1970 to 1975. This groundwater had a mean temperature of 41.35 degrees C, a relatively high mineral content, and a marked corrosive property. It is inferred from these characteristics and the occurrence of the aquifer in a volcanic region that the water is of magmatic origin. Changes in the physico-chemical characteristics of the thermal groundwater over time indicate contamination of the aquifer due to infiltration by groundwater in the region through a corroded well casing and do not indicate infiltration by seawater. (Collier-IVI)

CLASSIFICATION AND DESCRIPTION OF DOLOMITIC FABRICS OF ROCKS FROM THE FLORIDAN AQUIFER, U.S.A., Florida Univ., Gainesville. Dept. of Geology. A. F. Randazzo, and L. G. Zachos. Sedimentary Geology, Vol. 37, No. 3, p 151-162, 1983/1984. 8 Fig. 1 Tab, 9 Ref.

Descriptors: *Floridan Aquifer, *Florida, *Dolomites, Geologic formations, Mineralogy, Litholo-

Biozones of the Lake City Formation, Avon Park Formation and Ocala Limestone are characterized by interbedded, massive, fossiliferous carbonate rocks (wackestones to grainstones) and thinly bedded, peloidal and carbonacous rocks (mudstones and wackestones). Several horizons have been partly or completely dolomitized. A wide range of early to late stages of dolomitic fabrics are recognized. The fabrics are classified descriptively as equigranular (multimodal). Fabrics composed of crystals < 0.002 mm in diameter (unresolvable) are termed aphanotopic. Equigranular fabrics include sutured mosaic and sieve mosaic fabrics, and a somewhat problematic fabric. Inequigranular fabrics include porphyrotopic, polikilotopic, fogged mosaic and spotted mosaic fabrics. Two processes of dolomitization are suggested: (a) homogeneous dolomitization resulting in a single-stage development of microtextured (groundmass crystals < 0.016 mm in diameter) aphanotopic, peloidal and mosaic fabrics; and (b) heterogeneous dolomitization resulting in multistage development of porphyrotopic and some mosaic fabrics. It is possible to deduce the original depositional fabric and lithofacies from the dolomitic fabric except where extensive neomorphism has occurred. (Author's abstract)

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWEST-

ERN OKLAHOMA, PREDEVELOPMENT TO

Geological Survey, Oklahoma City, OK. Water Resources Div. J. S. Havens. USGS Water-Resources Investigations Report 83-4073, 1983. 1 Map sheet, 1 Fig, 8 Ref.

Descriptors: *Aquifers, *Water table, *Oklahoma, *Maps, *High Plains Regional Aquifer System.

*Maps, *High Plains Regional Aquifer System. The High Plains aquifer in Oklahoma is part of a regional aquifer system extending from South Dakota southward to Texas and New Mexico. The principal aquifer, the Ogallala Formation of Tertiary age, is hydraulically connected with other unconsolidated deposits, principally of Quaternary age. During 1978, the U.S. Geological Survey began a 5-year study of the High Plains regional aquifer system to provide hydrologic information for evaluation of the aquifer and to develop predictive computer models of it. This report consists of a map showing the water-level changes from predevelopment to 1980 in the High Plains aquifer in Oklahoma, approximately 40 years after irrigation began in the Oklahoma Panhandle. Water-level declines of more than 100 feet have occurred declines of Guymon, in Texas County. Lerser declines have occurred northeast, northwest, and southwest of Guymon. These declines reflect the areas of greatest ground-water withdrawal. Smaller areas of 100-foot declines have occurred in Woodward and Ellis Counties. An area of 50-foot water-level rise has occurred east of Boise City in Cimarron County. (USGS)

WATER RESOURCES OF THE FORT UNION COAL REGION, EAST-CENTRAL MONTANA, Geological Survey, Helena, MT. Water Resources Div.

Div. S. E. Slagle.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4151, December 1983. 37 p, 9 Fig. 4 Tab, 82 Ref.

Descriptors: Groundwater, *Groundwater availability, Surface water, Water quality, *Montana, Williston Basin, Fort Union Formation.

Williston Basin, Fort Union Formation.

The shallow ground-water system in the Fort Union coal region overlies the Upper Cretaceous Bearpaw Shale. It includes the Upper Cretaceous For Hills Sandstone and the overlying Hell Creek Formation, Paleocene Fort Union Formation, and Pleistocene and Holocene glacial deposits, terrace deposits, and alluvium. Two general flow patterns are present in aquifers above the Hell Creek Formation and a third may occur in the Fox Hills-lower Hell Creek aquifer. Recharge to the shallow ground-water system from direct infiltration of snowmelt and rainfall is about 50,000 acre-ft/yr. Discharge from the system is to perennial streams (about 5,000 acre-ft/yr to the Redwater River), withdrawal by wells (about 2,000 acre-ft/yr for ilvestock use and 2,500 acre-ft/yr for domestic use), and 34 to 45 in./yr to evapotranspiration. Primary constituents in water above the Hell Creek Formation are sodium, bicarbonate, and sulfate, and dissolved-solids concentrations are about 1,800 mg/L; water below a depth of about 200 feet contains more sodium and bicarbonate. Water in the Fox Hills-lower Hell Creek aquifer has an average dissolved-solids concentration of 1,180 mg/L. Flows in most streams have large seasonal variations, with the largest flows occurring in the spring as a result of snowmelt and rainfall. Dissolved-solids concentrations of streams generally are largest during low flow and smallest during high flow. Concentrations ranged from 160 to 6,960 mg/L in small streams and from 400 to 600 mg/L in the Missouri and Yellowstone Rivers. (USGS) W85-01772

GEOHYDROLOGY OF THE MEADOWBROOK ARTIFICIAL-RECHARGE PROJECT SITE IN EAST MEADOW, NASSAU COUNTY, NEW YORK,

Geological Survey, Albany, NY. Water Resources

Div. D. A. Aronson, J. B. Lindner, and B. G. Katz. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report, 1983. 44 p, 19 Fig, 8 Tab, 34 Ref.

Descriptors: *Groundwater recharge, *Induced infiltration, *Groundwater movement, *Reclaimed water, Water quality, Recharge basins, Injection wells, Computer models, *Long Island, Recharge facilities, Index materials, *New York.

facilities, Index materials, *New York.

In Nassau and Suffolk Counties, where the quality and quantity of potable ground water has declined as the result of urbanization, the use of reclaimed wastewater to replenish the ground-water reservoir is technically feasible. A system of 11 recharge basins and 5 shallow injection wells will return 4 million gallons per day of reclaimed wastewater to the ground-water reservoir. Results of a two-dimensional flow analysis of pump-test data were incorporated into a finite-difference regional flow model to predict changes in head from artificial recharge in and around the recharge site. A maximum water-table rise of 17 feet is predicted beneath the recharge basins under 'worst-case' conditions; buildups will be somewhat higher near the injection wells. The predicted maximum increase in streamflow at East Meadow Brook is 3.5 cubic feet per second. The projected chemical quality of the treated effluent to be used for aquifer recharge will be superior to that of water already present in the upper part of the ground-water recharge will be superior to that of water alreasy present in the upper part of the ground-water reservoir at the recharge site. Therefore, the recharge effort should improve both the quantity and quality aspects of the ground-water in the vicinity of the recharge site. (USGS) W85-01774

GENERALIZED ALTITUDE AND CONFIGURATION OF THE WATER TABLE IN PARTS OF LARIMER, LOGAN, SEDGWICK, AND WELD COUNTIES, COLORADO, Geological Survey, Lakewood, CO. Water Resources Div.

R. G. Borman, and N. G. Gaggiani. USGS Water-Resources Investigations Report 82-4055, 1983. 1 Map sheet, 2 Fig, 8 Ref.

Descriptors: *Groundwater, *Water table, Unconfined aquifers, Geologic formations, *Colorado, Ogallala Formation, White River Formation.

The water table in parts of Larimer, Logan, Sedgwick, and Weld Counties, Colorado ranges from about 7,000 feet above the National Geodetic Vertical Datum of 1929 (formerly called mean sea level) in eastern Larimer County to about 3,450 feet in northeastern Sedgwick County. Water is moving to the south and southeast in much of the study area. (USGS)

EXPLORATORY DRILLING AND AQUIFER TESTING AT THE KIPAHULU DISTRICT HALEAKALA NATIONAL PARK, MAUI, HAWAII, Geological Survey, Honolulu, HI. Water Resources Div. W. R. Souza.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4066, 1983. 21 p, 6 Fig. 3

Descriptors: Drilling, *Aquifer testing, Confined groundwater, Perched groundwater, Groundwater recharge, *Well hydrograph, *Discharge hydrograph, *Hawii, Maui.

An exploratory well, located at 388 feet above sea level in Kipahulu Valley on Maui, Hawaii, was completed and tested in October 1980. The 410completed and tested in October 1980. The 410-foot well penetrates a series of very dense basaltic lava flows of the Hana Formation. At an elevation of 10 feet above mean sea level, the well penetrated ed a water-bearing zone of permeable basaltic rock. Water from this zone had a head of about 76 feet above sea level. In October of 1980, the well was pump tested for 9 hours at various discharge

rates up to 350 gallons per minute with a maximum drawdown of about 12 feet. Based on the test data, the well should produce water at a rate of 200 gallons per minute with a drawdown of less than 3 feet. The water level in the well was continuously monitored from October 1980 to mid-November 1981, during which period a maximum decline of 20 feet was recorded. Water level fluctuations in the well can be correlated to the flow in nearby Palikea Stream. The long-term water level in the well should stabilize at about 75 feet above sea level. Water quality was excellent. The total dissolved-solids content was 49 milligrams per liter and the chloride content was 4.2 milligrams per liter. (USGS) liter. (USGS) W85-01776

GROUND WATER IN THE TWENTY-NINE PALMS INDIAN RESERVATION AND VICINITY, SAN BERNARDINO COUNTY, CALIFORNIA, Geological Survey, Sacramento, CA. Water Resources Div.

J. R. Freckleton.

J. K. Freckieton. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$7.50 in paper copy, \$4.00 in microfiche. USGS Water Resources In-vestigations Report 82-4060, October 1982. 46 p, 2 Fig. 6 Tab, 10 Ref.

Descriptors: *Groundwater, Hydrology, Geology, Drillers logs, Chemical analysis, Yield, Well, Pre-cipitation, *California, Twenty-Nine Palms Indian Reservation, San Bernardino County.

Reservation, San Bernardino County.

The Twenty-Nine Palms Indian Reservation is in San Bernardino County, California. Movement of ground water in the area is impeded locally by faults which act as ground-water barriers. There are indications that a fault probably crosses the reservation in an east-west direction; such a fault may interfere with ground-water pumping. The water-table altitude near the northern boundary of the reservation is estimated to be 120 to 130 feet below land surface datum; the aquifer thickness in the area is unknown. Pumping-test results for wells near the reservation show specific capacities ranging from 9.2 to 70.0 gallons per minute per foot of drawdown. Wells drilled on the reservation would probably fall within this range. Sodium concentrations, which may pose a hazard to those who must restrict its intake, and excessive fluoride are present in water samples from wells near the reservation. High sodium and fluoride concentrations are probably present in water in the saturated material underlying the reservation. (USGS) W85-01779

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION), Geological Survey, Denver, CO. Water Resources

R. A. Kierstein.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water Resources Investigations Report 83-4275, 1984. 73 p, 14 Fig, 7

Descriptors: *Computor programs, Geologic fractures, Well logs, Logging, Televiewer, *Magnetometer, Hole deviation, *Fracture attitude.

The attitude of fractures measured on acoustic-televiewer logs may be misorientated by as much as 180 degrees in a drill hole that is deviated significantly from vertical, because of the effect of the vertical component of the magnetic field on the tilted magnetometer that is used to orient the log. A method has been developed to correct for the A method has been developed to correct for the misorientation by analyzing the orientation of the magnetometer with respect to the magnetic-field vector acting at the magnetometer's center. Computer programs were written to correct the attitude of fractures for both magnetic effects and hole deviation. For the reorientation of a single fracture, a stereographic solution is illustrated. Test results suggest that the fracture orientation can be corrected to plus or minus five degrees of true

orientation, provided there are no other magnetic effects, such as magnetite in the rocks. (USGS) W85-01780

EFFECTS OF THE DROUGHT OF 1980-81 ON STREAMFLOW AND ON GROUND-WATER LEVELS IN GEORGIA,

Geological Survey, Doraville, GA. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01783

GROUND-WATER QUALITY IN THE WEST-ERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO,

Geological Survey, Boise, ID. Water Resources

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4062, 1983. 85 p, 19 Fig. 11 Tab, 40 Ref.

Descriptors: *Water quality, Water quality standards, *Groundwater, *Baseline studies, *Aquifers, Chemical analysis, *Hydrogeology, Water wells, Elmore County, *Idaho, Owyhee County, Bruneau River, Mountain Home, Western Snake River basin, Snake River valley.

basin, Snake River valley.

Water-quality data were collected from 92 wells in the western Snake River basin, Swan Falls to Glenns Ferry, Idaho. Current data were compiled with pre-1980 data from 116 wells to define water-quality conditions in major aquifers. Factors affecting water quality are composition of aquifer materials, water temperature, and source of recharge. Mixing of water by interaquifer flow, from confined, hot water aquifers (40 degrees Celsius or greater) with water from cold water aquifers (less than 20 degrees Celsius) occurs along regional complex fault systems, and through partially cased boreholes. Cold water generally contains calcium, magnesium, and bicarbonate plus carbonate ions. Warm water (between 20 degrees and 40 degrees Celsius) has an intermediate chemical composition resulting from mixing. Ground-water quality is acceptable for most uses, although it locally contains chemical constituents or physical properties that may restrict its use. Effects of thermal water used for irrigation on quality of shallow ground water are inconclusive. I one-sterm increase; in concentrations. irrigation on quality of shallow ground water are inconclusive. Long-term increase in concentrations of several constituents in parts of the study area may be due to effects of land- and water-use activities, such as infiltration of septic-tank effluent. (USGS) W85-01784

REGIONAL GEOHYDROLOGY OF THE REGIONAL GEOHYDROLOGY OF THE
NORTHERN LOUISIANA SALT-DOME
BASIN, PART III, POTENTIOMETRIC
LEVELS OF THE WILCOX-CARRIZO AND
SPARTA AQUIFERS,
Geological Survey, Baton Rouge, LA. Water Re-

Geological Survey, Baton Rouge, E.A. Water Sources Div. G. N. Ryals. Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS WRI Report 83-4131, 1983. 10 p, 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Maps, *Potentiometric level, Aquifers, Contours, Water-level fluctuations, Well hydrographs, *Louisiana, Wilcox-Carrizo aquifer, Sparta aquifer.

The potentiometric surface of the Wilcox-Carrizo aquifer in northwestern Louisiana is shown by contours using data collected from 1960-80. The aquifer is not affected by regional water-level declines, as no large pumping centers have been developed. Seasonal water-level fluctuations shown by the hydrographs of seven wells are developed. Seasonal water-level incutations shown by the hydrographs of seven wells are generally less than 10 feet annually. The spring 1980 potentiometric surface of the Sparta aquifer in northern Louisiana and southern Arkansas is shown by contours. Water-level measurements in Arkansas were made March 18-21, 1980, and in

Field 2-WATER CYCLE

Group 2F-Groundwater

Louisiana, May 19-21, 1980. Intensive pumping of the aquifers throughout northern Louisians and southern Arkansas has caused a regional lowering of water levels. This regional water-level decline is shown by the hydrographs of six wells. (USGS) W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYO-MING, Geological Survey, Cheyenne, WY. Water Re-sources Div.

For primary bibliographic entry see Field 7C. W85-01787 sources Div.

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTH-ERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING, Geological Survey, Denver, CO. Water Resources Div.

For primary bibliographic entry see Field 7C. W85-01790

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA, Geological Survey, Helena, MT. Water Resources Div.

M. R. Cannon Available from OFSS, USGS, Box 25425, Fed, Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4229, December 1983. 33 p, 6 Fig. 3 Tab, 29 Ref.

Descriptors: *Coal mines, Hydrology, Fort Union coal region, *Montana, *Mining impacts.

The Bloomfield coal tract in Dawson County, Montana, contains about 420 million tons of recoverable coal reserves within the Pust coal bed. About 136 million tons of coal within the tract is Federally owned, of which 98 million tons has been identified for potential lease sale. A hydrolog-ic study has been conducted in the potential lease area to describe existing hydrologic systems and to assess potential impacts of surface coal mining on local water resources. Shallow ground-water re-sources in the tract are limited to sandstone and sources in the tract are limited to sandstone and coal aquifers in the Tongue River Member of the Fort Union Formation (Paleocene age). These shallow aquifers have small values of hydraulic conductivity, yields to wells generally range from 1 to 10 gallons per minute. Water from shallow sandstone and coal aquifers is used primarily for livestock watering and domestic supply. Chemical analyses indicate that water from most shallow aquifers is dominated by calcium and magnesium cations and sulfate and bicarbonate anions. Surface-water resources in the tract consist primarily ater resources in the tract consist primarily of small reservoirs used for livestock watering. All streams in the tract are ephemeral, making them unreliable as a source of livestock water. Mining of the Pust coal bed would cause certain impacts on local water resources. About 15 stock and domestic wells and 13 small stock reservoirs would be detected by a prime Schelle resource. tic wells and 13 small stock reservoirs would be destroyed by mining. Shallow coal and sandstone aquifers would be permanently removed from parts of the tract. Leaching of soluble salts from mine spoils may cause a long-term degradation of the quality of water in shallow aquifers in or near the coal tract. Impacts on the local water resources could be mitigated by development of alternative ground-water supplies from deeper aquifers in the Fort Union and in the Upper Cretaceous Hell Creek and Fox Hills Formations. Reservoirs destroyed by mining could be reconstructed during stroyed by mining could be reconstructed during mine reclamation. (USGS)
W85-01791

MAJOR INSTITUTIONAL ARRANGEMENTS AFFECTING GROUND WATER IN NEW YORK

STATE, Cornell Univ., Ithaca, NY. Dept. of City and Re-gional Planning.

For primary bibliographic entry see Field 6E. W85-01802

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOM-ERY COUNTIES, TEXAS, 1975-79, Geological Survey, Austin, TX. Water Resources

K. W. Ratzlaff, W. B. Lind, and C. E. Ranzau. Texas Department of Water Resources Report 280, Austin, September 1983. 37 p, 3 Fig, 11 Tab, 5 Ref.

Descriptors: *Groundwater, Drillers' logs, *Water levels, *Chemical analyses, *Texas, Chambers County, Liberty County, Montgomery County.

Information on major new water wells in Chambers, Liberty, and Montgomery Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these countries and descriptive evaluations of the ground-water resources which have been published previously. (USGS) W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79, Geological Survey, Austin, TX. Water Resources

K. W. Ratzlaff, C. E. Ranzau, and W. B. Lind. Texas Department of Water Resources, Austin, Report 277, July 1983. 55 p, 3 Fig, 12 Tab, 5 Ref.

Descriptors: *Ground water, Drillers' logs, Water levels, *Chemical analyses, *Texas, Brazoria County, Fort Bend County, Waller County.

Information on major new water wells in Brazoria, Fort Bend, and Waller Counties was compiled by the U.S. Geological Survey from 1975 to 1979. This report presents the results of the hydrologic data collection on new large-capacity and other selected wells, including well location and completion data, drillers' logs of the strata penetrated, water levels, and chemical quality of the produced water. These water-well data are supplementary to similar data on older wells in these counties and descriptive evaluations of the ground-water resources which have been published previously. (USGS) W85-01819

GUIDE TO NORTH DAKOTA'S GROUND-WATER RESOURCES,
Geological Survey, Bismarck, ND. Water Re-

sources Div. Q. F. Paulson.

Available from the Distr. Br., USGS, 604 S. Pickett St., Alex., VA 22304. USGS Water-Supply Paper 2236, 1983. 25 p, 30 Fig, 6 Tab, 18 Ref.

Descriptors: *Groundwater availability, *Groundwater quality, *Groundwater contamination, *Groundwater management, Groundwater hydrology, Surface-groundwater relations, Water use, Water law, *North Dakota.

More than 60 percent of North Dakota's popula-tion uses ground water for one purpose or another. The State has a good potential for further groundand state has a good potential for turther ground-water development based on information collected in county ground-water studies during the past 25 years. However, the development will involve dif-ficult problems because of salinity, uneven distribu-tion of aquifers, and insufficient aquifer recharge (replenishment). The solution to these and other complex geohydrologic problems will require sound management practices using modern tech-nology including computer modeling of aquifers.

The most productive aquifers consist of linear-shaped bodies of sand and gravel that were depos-ited from melting glaciers some tens of thousands of years ago. Yields from these aquifers, which occur mostly north and east of the Missouri River, are commonly between 50 and 500 gallons are minute, and, in places, exceed 500 gallons a minute. Ground water also is obtainable from sandstone, lignite and limestone aquifers in the bedcock. The Ground water also is obtainable from sandstone, lignite, and limestone aquifers in the bedrock. The ground water generally is bacterially safe and has not been affected by toxic wastes. However, in some parts of North Dakota the ground water is so mineralized or saline that is only of limited use. (USGS) W85-01824

INSTRUMENTATION USED FOR HYDRAU-LIC TESTING OF POTENTIAL WATER-BEAR-ING FORMATIONS AT THE WASTE ISOLA-TION PILOT PLANT SITE IN SOUTHEAST-ERN, NEW MEXICO,

Geological Survey, Albuquerque, NM. Water Resources Div. For primary bibliographic entry see Field 7B. W85-01827

FLUORIDE, NITRATE, AND DISSOLVED-SOLIDS CONCENTRATIONS IN GROUND WATERS OF WASHINGTON,

Geological Survey, Tacoma, WA. Water Resources Div. W. E. Lum, II, and G. L. Turney

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 82-508, 1981. 4 Map Sheets, 4 Fig, 8 Ref.

Descriptors: *Groundwater, *Nitrate, *Dissolved solids, *Fluoride, Geochemistry, Chemical quality, Water quality, *Maps, *Washington, Groundwater region designations, Groundwater contamination.

This study provides basic data on ground-water quality throughout the State. It is intended for uses in planning and management by agencies and individuals who have responsibility for or interest in, public health and welfare. It also provides a basis for dispersion future studies of ground-water quality. viduals who have responsibility for or interest in, public health and welfare. It also provides a basis for directing future studies of ground-water quality toward areas where ground-water quality problems may already exist. The information presented is a compilation of existing data from numerous sources including: the Washington Departments of Ecology and Social and Health Services, the Environmental Protection Agency, as well as many other local, county, state and federal agencies and private corporations. Only data on fluoride, nirrate, and dissolved-solids concentrations in ground water are presented, as these constituents are among those commonly used to determine the suitability of water for drinking or other purposes. They also reflect both natural and man-imposed effects on water quality and are the most readily They also reflect both natural and man-imposed effects on water quality and are the most readily available water-quality data for the State of Washington. The percentage of wells with fluoride, nitrate, or dissolved-solids concentrations exceeding U.S. Environmental Protection Agency Primary and Secondary Drinking Water Regulations were about 1, about 3, and about 3, respectively. Most high concentrations occurred in widely separated wells. Two exceptions were: high concentrations of nitrate and dissolved solids in wells on the Hanford Department of Energy Facility and high concentrations of nitrate in the lower Yakima River basin. (USGS) W85-01828

DEVELOPING THE RESOURCE POTENTIAL OF A SHALLOW WATER TABLE

California Univ., Davis. Dept. of Land, Air and Water Resources. For primary bibliographic entry see Field 3B. W85-01832

WATER RESOURCES DATA, KENTUCKY, WATER YEAR 1982.

Geological Survey, Louisville, KY. Water Resources Div. For primary bibliographic entry see Field 2E.

Groundwater-Group 2F

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE PRINCIPAL GROUNDWATER RESERVOIR OF THE SEVIER DESERT, UTAH, Geological Survey, Salt Lake City, UT. Water Resources Div. For primary bibliographic entry see Field 7C. W35-01925

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER, NORTHWESTERN MISSISSIPPI, APRIL, 1982,

Geological Survey, Jackson, MS. Water Resources Div. For primary bibliographic entry see Field 7C. W85-01926

ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, NEW **MEXICO, 1982,**

Geological Survey, Albuquerque, NM. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01927

DATA FOR GROUND-WATER TEST HOLE NEAR NICOLAUS, CENTRAL VALLEY AQUI-FER PROJECT, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 7C. W85-01929

HYDROLOGIC MAPS OF THE HIGH PLAINS AQUIFER, JANUARY 1981, SOUTHWESTERN KANSAS, Geological Survey, Lawrence, KS. Water Resources Div.

For primary bibliographic entry see Field 7C. W85-01930

WATER RESOURCES DATA, IOWA, WATER **YEAR 1982.** Geological Survey, Iowa City, IA. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01931

WATER RESOURCES DATA, KANSAS WATER YEAR 1982, Geological Survey, Lawrence, KS. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01932

WATER RESOURCES DATA, NEW HAMP-SHIRE AND VERMONT, WATER YEAR 1982, Geological Survey, Boston, MA. Water Resources For primary bibliographic entry see Field 2E. W85-01933

WATER RESOURCES DATA, ARKANSAS, WATER YEAR 1982, Geological Survey, Little Rock, AR. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01934

WATER RESOURCES DATA, MASSACHU-SEITS AND RHODE ISLAND, WATER YEAR 1982.

Geological Survey, Boston, MA. Water Resources For primary bibliographic entry see Field 2E. W85-01935

WATER RESOURCES DATA, NORTH DAKOTA, WATER YEAR 1982, Geological Survey, Bismarck, ND. Water Re-sources Div. For primary bibliographic entry see Field 2E. W85-01936

WATER RESOURCES DATA, SOUTH CAROLI-NA, WATER YEAR 1982, Geological Survey, Columbia, SC. Water Re-sources Div. For primary bibliographic entry see Field 2E. W85-01937

WATER RESOUR WATER YEAR 1982, RESOURCES DATA, GEORGIA, Geological Survey, Doraville, GA. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01938

WATER RESOURCES DATA, ALABAMA, WATER YEAR 1982, Geological Survey, Tuscaloosa, AL. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01939

TRENDS AND FLUCTUATIONS IN THE PO-TENTIOMETRIC SURFACE OF THE FLORI-DAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80, Geological Survey, Tallahassee, FL. Water Resources Div. For primary bibliographic entry see Field 7C. W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQ-UIFER PROJECT, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Re-For primary bibliographic entry see Field 7C. W85-01941 sources Div.

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, APRIL 1983, Geological Survey, Jackson, MS. Water Resources For primary bibliographic entry see Field 7C. W85-01944

SHALLOW GROUND-WATER FLOW AND DRAINAGE CHARACTERISTICS OF THE BROWN DITCH BASIN NEAR THE EAST UNIT, INDIANA DUNES NATIONAL LAKE-SHORE, INDIANA, 1982, Geological Survey, Indianapolis, IN. Water Resources Div. For primary bibliographic entry see Field 4A. W85-01948

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA, Geological Survey, Huron, SD. Water Resources

S. D. McCrarvie.
South Dakota, Dept. of Water and National Resources, (Vermillion), Information Pamphlet No. 20, 1983. 10 p, 3 Fig, 1 Tab.

Descriptors: *Aquifers, Hydrogeology, *Ground-water, Water quality, *South Dakota, Miner County.

Outwash sand and gravel occurs throughout Miner County, S.D., at depths ranging from 0 to 500 feet below land surface. In places, the deposits are hydrologically connected and form major glacial aquifers. The Floyd aquifer underlies about 180 square miles of Miner County at depths ranging from 25 to 150 feet below land surface. Thickness ranges from 10 to 100 feet and wells may yield as much as 1,200 gallons per minute. Other outwash aquifers under lie an additional 195 square miles of Miner County. The Niobrars Formation is the aquirers under he an additional 195 square miles of Miner County. The Niobrara Formation is the uppermost bedrock aquifer in the county and underlies all but its southwest corner. The Niobrara is found at depths ranging from 60 to 600 feet below land surface. Thickness of the formation ranges from 10 to 120 feet. The Codell Sandstone Member of the Carlile Shale underlies the Niobrara Forma-

tion throughout the county at depths ranging from 120 to 720 feet below land surface. Thickness of the Codell ranges from 10 to 100 feet. The Dakota Sandstone underlies most of the northwest half of Miner County. Depth to the Dakota ranges from 30 to 1,000 feet below land surface and thickness ranges from 10 to 400 feet. The Dakota Sandstone is underlain by the Sioux Quartzite which contains relatively large amounts of water in joints and fractures. Each of the aquifers in Miner County provides adequate supplies of water for domestic and stock use. The Floyd aquifer offers the greatest potential for irrigation or other large-yield development. (USGS) W85-01950

FEASIBILITY STUDY OF DEVELOPING VALLEY-FILL AQUIFERS FOR VILLAGE WATER SUPPLIES IN SOUTHERN GUAM, Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific. J. F. Ayers, and R. N. Clayshulte. Technical Report No. 41, September, 1983. 96 p, 6 Fig, 8 Tab, 10 Ref. Project No. OWRT A-027-GÜAM(1), Contract/Grant No. 13-34-0001-2112.

Descriptors: *Alluvial aquifers, *Water supply development, *Groundwater potential, *Rural areas, Alluvium, Marine sediments, Aquifers, Irrigation wells, Groundwater irrigation, Geophysics, Seismology, Resistivity, *Guam.

Villages located in southern Guam occasionally experience domestic water supply shortages that affect both the home dweller and the farmer. Municipal water supplies are provided by the islandwide distribution system. Water is obtained from well fields which tap the complex Ghyben-Herzberg lens beneath the northern limestone plateau and is transported south at considerable cost. If alternative sources of freshwater can be located near the centers of high demand, the energy costs of pumping water long distances would be lowered, the reliability of the distribution system would be improved, the quantity of water extracted from the northern lens would be reduced, and lastly the village communities would become more self-sufficient in terms of water supply. Potential sources of groundwater sources of groundwater for domestic use have been identified near the outflow of the Inarajan River. Two water-bearing units of alluvium and shallow-water marine sediments overlie a partially weathered volcanic basement. From the results of the study it appears feasible to develop the groundwater resource, at least initially, on a limited scale. The quality of the product water is such that it could be used directly for agriculture purposes. Villages located in southern Guam occasionally

DIAGENESIS AND PORE-SPACE EVOLUTION WITHIN RECENT AND PLEISTOCENE CARBONATE UNITS OF OROTE PENINSULA, GUAM,

Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific. R. N. Clayshulte, and J. F. Ayers.

Technical Report No. 47, December, 1983. 119 p. 7 Fig, 11 Tab, 35 Ref, 2 Append. Project No. OWRT A-025-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Carbonates, *Diagenesis, Porosity, Limestone, Reefs, Carbonate rocks, Lithification, Sedimentation, Groundwater, Vadose water, Marine geology, Aquifers, Porous media, *Guam, Orote Peninsula.

The Mariana limestone on Orote Peninsula has undergone diagenetic modification under marine phreatic, freshwater and freshwater vadose condiphreatic, freshwater and freshwater valores condi-tions. Marine diagenetic modification from internal sediment fill, submarine cementation and borings have produced partial to complete occlusion of primary interparticle porosity. Marine sediments are lithified by cements similar to those found in the modern reef complex. Within the freshwater phreatic environment, nearly all interparticle po-rosity is occluded with some secondary porosity ration. There has also been preferential disso

Field 2-WATER CYCLE

Group 2F-Groundwater

lution of, primarily, aragonitic clasts, which creates distinctive moldic porosity. There is only minor diagenetic alternation within the freshwater vadose W85-02027

HYDROGEOLOGIC INVESTIGATION OF AGANA SWAMP NORTHERN GUAM, Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific. J. F. Ayers, and R. N. Clayshulte.

Technical Report No. 40, September, 1983. 30 p, 6 Fig. 1 Tab, 10 Ref. Project No. OWRT A-026-GUAM(1), Contract/Grant No. 14-34-0001-2112.

Descriptors: *Geohydrology, *Swamps, *Carbonates, *Groundwater movement, Groundwater, Groundwater basins, Aquifers, Groundwater potential, Geophysics, Seismology, Limestone, Carbonate rocks, *Guam, Agana Swamp.

An attempt was made to investigate the hydraulic relationship between Agana Swamp, located near the village of Agana, and the freahwater lens beneath the limestone plateau of northern Guam. A number of problems developed during the course of the study which prompted a change in the project objectives. The main problems were access to the study area and artificial features which prevented the full application of geophysical surveys and the installation of an observation-well network. The study, however, points out a number of aspects such as the general geology and physiography of the swamp area, its drainage characteristics, and the occurrence of groundwater. In addition, the results of the investigation have been useful in constructing a set of guidelines for further study. study. W85-02029

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK, Geological Survey, Albany, NY. Water Resources

Div. For primary bibliographic entry see Field 7B. W85-02030

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA,

Geological Survey, Denver, CO. Water Resources For primary bibliographic entry see Field 7C. W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-

Geological Survey, Albany, NY. Water Resources

For primary bibliographic entry see Field 7C. W85-02034

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY AND PARTS OF CASS AND MORRISON COUNTIES, CENTRAL MINNESOTA, Geological Survey, St. Paul, MN. Water Re-sources Div.

For primary bibliographic entry see Field 4B. W85-02038

AQUIFER TESTS IN THE STRATIFIED DRIFT, CHIPUXET RIVER BASIN, RHODE ISLAND, Geological Survey, Providence, RI. D. C. Dickerman.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4321, 1984. 39 p, 16 Fig. 7 Tab, 24 Ref.

Descriptors: *Aquifer, Aquifer test, *Transmissi-vity, *Hydraulic conductinity, *Storage coeffi-cient, *Specific yield, Chipuxet River ground-water reservoir, *Stratified drift, *Rhode Island.

Analyses of 18 aquifer tests in the Chipuxet River basin in southern Rhode Island indicate that the stratified-drift this aquifer is generally highly transmissive and would yield large quantities of water to properly constructed wells. The aquifer is an irregularly shaped body of coarse sand and gravel deposited by glacial streams during the last Pleistoicene ice advance. This heterogenous, anisotropic water-table aquifer is composed of stratified drift consisting of complexly interbedded lenses of sand and gravel and subordinate amounts of silt and silty sand. The tests were made in the thick, nermeconsisting of complexly interconduct renses of same and gravel and subordinate amounts of silt and silty sand. The tests were made in the thick, permeable parts of the stratified drift, which forms a major ground-water reservoir in the lower reaches of the Chipuxet River basin. The analytical method most often used, and whose assumptions closely approximate field conditions, was a method by R. W. Stallman intended for vertical movement in an unconfined, anisotropic aquifer. The transmissivity of the stratified-drift aquifer ranged from 5,000 to 39,100 square feet per day. The horizontal hydraulic conductivity ranged from 3 to 52 feet per day. The ratio of vertical to horizontal hydraulic conductivity ranged from 3 to 52 feet per day. The ratio of vertical to horizontal hydraulic conductivity of the stratified-drift aquifer ranged from 1:5 to 1:80. (USGS) W85-02039

RECHARGE AND DISCHARGE AREAS OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DIS-TRICT AND VICINITY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

For primary bibliographic entry see Field 7C. W85-02049

ALTITUDE AND GENERALIZED CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, ST. JOHNS COUNTY, FLORIDA, Geological Survey, Jackson, MS. Water Resources

For primary bibliographic entry see Field 7C. W85-02050

HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2-DEVELOPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIFFERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW, Contaction from the Part of the Part of

Geological Survey, Tallahassee, FL. Water Resources Div. C. B. Hutchins

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. Water-Resources Investigations Report 84-4002, 1984. 174 p, 40 Fig, 9 Tab, 29 Ref.

Descriptors: *Computer models, *Groundwater movement, *Hydrogeology, *Water management (applied), Pumping, *Evapotranspiration, Tampa, Hilsborough County, *Florida.

This report describes a quasi-three-dimensional finite-difference model for simulation of steady-state ground-water flow in the Floridan aquifer over a 932-square-mile area that contains 10 municipal well fields. The over-lying surficial aquifer contains a water table and is coupled to the Floridan aquifer by leakage term that represents flow through a confining layer separating the two aquifers. Under the steady-state condition, all storage terms are set to zero. Use of the head-controlled flux condition allows simulated head and flow changes to occur in the Floridan aquifer at the model boundaries. Procedures used to calibrate the model, test its sensitivity to input-parameter errors, and validate its accuracy for predictive purposes are described. Also included are attachments that describe setting up and running the purposes are escribed. Also includes a sustainments that describe setting up and running the model. Example model-interrogation runs show anticipated drawdowns under high, average, and low recharge conditions with 10 well fields pumping simultaneously at the maximum annual permitted rates totaling 186.9 million gallons per day. (USGS)

INFLUENCE OF SIMULATED GROUNDWAT-ER-MOVEMENT ON THE PHOSPHORUS RE-LEASE FROM SEDIMENTS, AS MEASURED IN A CONTINUOUS FLOW SYSTEM, Amsterdam Univ. (Netherlands). Lab. voor Micro-

L. van Liere, and L. R. Mur.

Hydrobiologia, Vol. 92, p 511-518, July, 1982. 8 Fig. 9 Ref.

Descriptors: *Groundwater movement, *Phosphorus, *Sediments, Flow, Interstitial water.

An experimental system based on a continuous flow reactor is presented in which undisturbed sediment cores can be investigated with regard to flow reactor is presented in which undisturbed sediment cores can be investigated with regard to the release of phosphorus to the overlying water and the characteristics of the interstitial water. In this system the effect of simulated vertical ground-water movement was also studied. The results of three preliminary experiments are shown: undisturbed core, core in which downward migration was stimulated, and core in which upward migration was stimulated. In all experiments the amount of released phosphorus rose very rapidly to high values, due probably in part to the effects of freeze/thaw on the cores, although no measurable shift in the interstitial profile was observed during thawing. The latter two experiments showed a rapid loss of phosphorus from the system in contrast to the first experiment. This process was reflected in the phosphorus concentration of the interstitial water. Restoration in regions with downward migration of sediment water is likely to be most rapid. In other regions the hydraulic retention time may become very important. (Baker-IVI) W85-02094

THREE-DIMENSIONAL STREAMLINES IN DUPUIT-FORCHHEIMER MODELS,

Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering. O. D. L. Strack.

Water Resources Research, Vol. 20, No. 7, p 812-822, July, 1984. 14 Fig, 16 Ref, 1 Append.

Descriptors: *Streamlines, *Dupuit-Forchheimer models, *Groundwater movement, Computer models, Flow resistance, Infiltration, Permeability, Model studies.

Model studies.

The modeling of steady regional aquifer flow is generally done by the use of two-dimensional numerical or analytical models that are based upon a Dupuit-Forchheimer approximation. An approximate method is presented for determining streamlines in three dimensions using two-dimensional Dupuit-Forchheimer models. This approach is based upon the interpretation of the Dupuit-Forchheimer assumption that the resistance to flow in the vertical direction is neglected. This assumption does not preclude the occurrence of flow in the vertical direction; vertical components of flow are determined in an approximate fashion by requiring continuity of flow. Its accuracy appears to depend primarily upon the variation with position of the rate of infiltration through the upper and lower boundaries of the aquifer considered. The approach may be used in computer models based on either numerical or analytical techniques. It is applicable to aquifers with layers of different permeabilities and will be particularly useful in determining flow paths in systems of stacked aquifers. In many problems of practical importance, the approximate method of determining streamlines in three dimensions may make it unnecessary to resort to three-dimensional models. (Moore-IVI) W85-02148

DOUBLE-POROSITY MODELS FOR A FIS-SURED GROUNDWATER RESERVOIR WITH FRACTURE SKIN.

Geological Survey, Menlo Park, CA. A. F. Moench.

Water Resources Research, Vol. 20, No. 7, p 831-846, July, 1984. 14 Fig, 4 Tab, 45 Ref, 3 Append.

Descriptors: *Porosity, *Groundwater movement, *Geologic fractures, Model studies, Permeability

coefficient, Hydraulic head, Flow resistance, Wells.

Theories of flow to a well in a double-porosity groundwater reservoir are modified to incorporate effects of a thin layer of low-permeability material or fracture skin that may be present at fracture-block interfaces as a result of mineral deposition or alteration. The commonly used theory for flow in double-porosity formations that is based upon the assumption of pseudo-steady state block-to-fissure flow is shown to be a special case of the theory presented in this paper. The latter is based on the assumption of transient block-to-fissure flow with fracture skin. Under conditions where fracture skin has a hydraulic conductivity that is less than that of the matrix rock, it may be assumed to impede the interchange of fluid between the fissures and blocks. Resistance to flow at fracture-block interfaces tends to reduce spatial variation of hydraulic head gradients within the blocks. This provides theoretical justification for neglecting the divergence of flow in the blocks as required by the pseudo-steady state flow model. Coupled boundary value problems for flow to a well discharging at a constant rate were solved in the Laplace domain. Both slab-shaped and sphere-shaped blocks were considered, as were effects of well bore storage and well bore skin. Results obtained by numerical inversion were used to construct dimensionless-type curves that were applied to well test data, for Theories of flow to a well in a double-porosity inversion were used to construct dimensionless-type curves that were applied to well test data, for a pumped well and for an observation dimension-less-type curves that were applied to well test data, for a pumped well and for an observation well, from the fractured volcanic rock terrane of the Nevada Test Site. (Author's abstract) W85-02150

FLUX-AVERAGED AND VOLUME-AVER-AGED CONCENTRATIONS IN CONTINUUM APPROACHES TO SOLUTE TRANSPORT, Virginia Polytechnic Inst. and State Univ., Blacks-

J. C. Parker, and M. Th. Van Genuchten.
Water Resources Research, Vol. 20, No. 7, p 866-872, July, 1984. 2 Fig., 1 Tab, 23 Ref.

Descriptors: *Solute transport. *Convection. *Dispersion, *Flux-averaged concentrations, *Volume-averaged concentrations, Mathematical equations, Boundary conditions, Porous media, Interstitial

Transformations between volume-averaged pore fluid concentrations and flux-averaged concentrations are presented which show that both modes of concentration obey convective-dispersive transport equations of identical mathematical form for non-reactive solutes. The pertinent boundary conditions for the two modes, however, do not transform identically. Solutions of the convection-dispersion equation for a semi-infinite system during steady flow subject to a first-type inlet boundary condition is shown to yield flux concentrations, while solutions subject to a third-type boundary condition yield volume-averaged concentrations. These solutions may be applied with reasonable impunity to finite as well as semi-infinite media if back mixing at the exit is precluded. Implications of the distinction between resident and flux concentrations to laboratory and field studies of solute transport are discussed. It is suggested that perceived limitations of the convection-dispersion model for media with large variations in pore water velocities may in certain cases be attributable to a failure to distinguish between volume-averaged and flux-averaged concentrations.

W85-02153

MOTION OF TWO COMPRESSIBLE FLUIDS WITH INTERFACE IN A POROUS RESER-

Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics

Div.
R. A. Wooding, and G. J. Weir.
Water Resources Research, Vol. 20, No. 7, p 873-886, July, 1984. 14 Fig, 2 Tab, 22 Ref.

Descriptors: *Groundwater movement, *Porous media, Groundwater reservoirs, Model studies,

Pressure, Gas-water interface, Leaky aquifers, Porosity, Permeability, Mathematical equations.

This paper describes the development of a physical model of a reservoir involving two compressible fluids, typically gas over water. The reservoir is assumed to be of constant thickness, but its height fluids, typically gas over water. The reservoir is assumed to be of constant thickness, but its height varies with position, leading to an undulating topography. Withdrawal of the upper fluid begins and proceeds at a constant rate. Topics of interest are the distribution of fluxes throughout the reservoir, the pressure field as a function of time and space, and the movement of the interface between the fluids. The problem is formulated using a version of the two-fluid layer concept. One of the space variables is eliminated by vertical integration, assuming that the fluid velocity vector is almost parallel to the upper and lower confining boundaries (Boussinesq reservoir). The resulting equation of motion for the horizontal components of the flow resembles that for a horizontal reservoir, but terms involving the gradient of the undulating reservoir modify the vertical pressure gradient. The problem is solved in two space dimensions and time. The difficulty presented by intersections of the fluid-fluid interface with one or other of the confining boundaries is resolved by introducing a mathematical continuation of the fluids and their interface through and past the boundary. This is particularly appropriate for 'leaky' aquifers; in the case of impermeable boundaries, a concern of the present paper, approximate solutions may be obtained by assuming a virtual porosity and permeability which are extremely small. The method present paper, approximate solutions may be obtained by assuming a virtual porosity and permeability which are extremely small. The method resembles that of Wilson and Sa da Costa (Water Resour. Res, 18, 1069-1080, 1982) Some useful results have been obtained for Boussinesq reservoirs of fairly arbitrary geometry. Approximate numerical solutions are presented for two-dimesional flow in a rectangular reservoir, the outer part of which is completely submerged, and for axisymmetric and three-dimensional flows in a circular quadrant. A constriction upon the gas flow due to a 'dip' in the reservoir is found to produce enhanced horizontal water flow due to the increase in horizontal pressure gradient. Downstream of the enhanced horizontal water flow due to the increase in horizontal pressure gradient. Downstream of the dip the interface develops an elevation, while a depression appears upstream. The establishment of stable flow of gas through a 'neck' between two gas reservoirs is demonstrated, and it is proposed that a similar type of flow can be developed as result of gas fingering through an initially submerged neck. Further applications of the technique could be to reservoirs containing steam over water (geothermal) or to the coastal saltwater intrusion problem, but these are not considered in the present paper. (Author's abstract) W85-02154

GROUNDWATER RESPONSE UNDER AN ELECTRONUCLEAR PLANT TO A RIVER FLOOD WAVE ANALYZED BY A NONLINEAR FINITE ELEMENT MODEL, Padua Univ. (Italy). Inst. of Applied Mathematics. G. Gambolati, F. Toffolo, and F. Uliana. Water Resources Research, Vol. 20, No. 7, p 903-913, July, 1984. 12 Fig, 1 Tab, 36 Ref.

Descriptors: *Groundwater level, *Flood waves, *Mathematical models, *Trino Vercellese, *Italy Nuclear powerplants, Water table, Finite element models, Permeability coefficient, Specific yield.

modeis, Permeability coefficient, specific yield.

In the foundation design of electronuclear plants, conservative stability criteria with respect to earthquakes are usually assumed, where the maximum water table level beneath the nuclear reactor in response to possible flood waves occurring in the nearby river is taken to coincide with the ground surface elevation. This approach may dictate heavier structural constraints; hence additional costs that could be minimized if a realistic prediction of the aquifer behavior and of the actual largest pressure head below the plant is provided by appropriate mathematical tools. A nonlinear finite element model based on the Dupuit-Boussinesq equation of flow in an unconfined aquifer has been developed and applied to simulate the water table fluctuation under the electronuclear plant of the test site of Trino Vercellese (nothwestern Italy) in response to the flood event that occurred in the Po River from March 30 to April 4, 1981. The nonlinearity has

been overcome by the aid of an efficient iterative linearization technique wherein the model equations are solved by symbolic factorization, numerical factorization, and backward-forward substitution after an optimal preliminary recording. The model was run for uniform values of aquifer permeability and specific yield within the typical range evidenced for the Trino sands by the early data in our possession. The results show that the maximum water level elevation below the reactor is almost 3 m lower than the corresponding river maximum water level elevation below the reactor is almost 3 m lower than the corresponding river flood peak even in the most unfavorable conditions, i.e., with the hydraulic conductivity in the upper range, and is rather insensitive to the specific yield values within the plausible interval. The model allowed for an easy evaluation of the effectiveness of the impermeable protection walls and of a possible secondary aquifer recharger from a minor channel. The modeling approach for the analysis of the water behavior appears to be a very promising tool to help in the structural design of future electronuclear plants. (Author's abstract) W85-02157

PRESSURE TRANSIENT ANALYSIS FOR TWO-PHASE GEOTHERMAL WELLS: SOME NUMERICAL DESIGITS

S-Cubed, La Jolla, CA S. K. Garg, and J. W. Pritchett. Water Resources Research, Vol. 20, No. 7, p 963-970, July, 1984. 26 Fig, 6 Tab, 12 Ref.

Descriptors: *Geothermal wells, *Pressure transient analysis, Geothermal reservoirs, Simulation, Mathematical models, Two-phase reservoirs, Flashing, Permeability, Kinematic mobility.

A numerical geothermal reservoir simulator is used in a series of calculations to help devise interpreta in a series of calculations to help devise interpretation techniques for analyzing pressure transient
data from two phase geothermal reservoirs. The
investigations include (1) the drawdown/buildup
behavior of initially two-phase (liquid water/
stream) reservoirs, (2) the drawdown/buildup response of initially single-phase reservoirs which
undergo flashing as a result of fluid production,
and (3) the effects of cold water injection into hot and (3) the effects of cold water injection into hot two-phase reservoirs. Production (drawdown/buildup) data from two-phase (either initially or due to production-induced boiling) reservoirs may be analyzed in the usual manner to yield kinematic mobility; buildup data from reservoirs which undergo flashing on production also offer the possibility of determining absolute formation permeability. Injection data can be interpreted in a straight. ity. Injection data can be interpreted in a straight-forward manner to yield absolute formation permeability; the corresponding falloff data appear, however, to be of little value. (Author's abstract) W85-02163

PARAMETER IDENTIFICATION GROUNDWATER AQUIFER MODELS: A GEN-ERALIZED LEAST SQUARES APPROACH,

California Univ., Los Angeles. School of Engineering and Applied Science.

J. Sadeghipour, and W. W.-G. Yeh.
Water Resources Research, Vol. 20, No. 7, p 971-979, July, 1984. 8 Fig. 4 Tab, 18 Ref. NSF grant CEE 81-13500.

Descriptors: *Transmissivity, *Least squares method, *Aquifers, Mathematical models, Groundwater, Hydraulic head, Parameter identification.

This paper concerns the methods of estimating aquifer transmissivities on the basis of unsteady state hydraulic head data. Traditionally, the critestate nydrauuc nead data. I raditionally, the criterion of minimizing the sum of the squares of errors has been used to match the observed data with the model response. The data used for optimization usually contain noise that is not necessarily uncorrelated. It is well understood that the results of identification without the contains the c identification methods are very sensitive to measurement errors in data. In this study, the ordinary least squares (OLS) technique is carried out along with a generalized least squares (GLS) technique specifically designed to reduce the effect of correlated errors. The trace of the covariance matrix is used as a measure of overall accuracy and reliability of the estimated parameters. The effectiveness

Field 2-WATER CYCLE

Group 2F-Groundwater

of the OSL and GLS techniques in dealing with noisy data is demonstrated by using a hypothetical example. The results of numerical experiments sug-gest that GLS offers a promising approach in efficiently improving the reliability of the estimat-ed parameters. (Author's abstract)

DARCY'S FLOW WITH VARIABLE PERME-ABILITY: A BOUNDARY INTEGRAL SOLU-

TION, Columbia Univ., New York. Dept. of Civil Engi-

neering. A. H.-D. Cheng. Water Resources Research, Vol. 20, No. 7, p 980-984, July, 1984. 8 Fig, 1 Tab, 11 Ref. NSF grant CEE-8307069.

Descriptors: *Permeability, *Mathematical equations, *Darcy's law, *Groundwater movement,

A boundary integral equation method (BIEM) for Darcy's flow with spatially varied permeability is developed. The numerical solution is efficient if a closed-form Green's function is available. The Green's functions are derived for a few permeability functions in one and two dimensions. The permeabilities can be used for simple fit of field permeability data. (Baker-IVI)
W85-02165

TRAVEL TIMES FROM BURIED AND SUR-

FACE INFILTRATION POINT SOURCES, Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.

For primary bibliographic entry see Field 2G. W85-02167

APPLICATION OF THE GEOSTATISTICAL APPROACH TO THE INVERSE PROBLEM IN TWO-DIMENSIONAL GROUNDWATER MOD ELING

Iowa Univ., Iowa City. Inst. of Hydraulic Re-

R. J. Hoeksema, and P. K. Kitanidis.

Water Resources Research, Vol. 20, No. 7, p 1003-1020, July, 1984. 21 Fig. 4 Tab, 20 Ref, 2 Append. lowa Water Resources Research Institute project CT 381702, NSF grant CME-8106577.

Descriptors: *Transmissivity, *Groundwater, *Geostatistical approach, *Jordan aquifer, *Iowa, Mathematical models, Hydraulic head, Covar-

A methodology is presented for the estimation of transmissivity from head and transmissivity measurements in the two-dimensional steady flow case following the geostatistical approach to inverse modeling. The field of the logarithm of transmissivity. modeling. The field of the logarithm of transmissi-vity (log-transmissivity) is represented as a zero-order intrinsic random field; its spatial structure is described in this application through a two-term covariance function that is linear in the parameter 01 and 02. Linearization of the discretized flow equations allows the construction of the joint co-variance matrix of the head and log transmissivity measurements as a linear function of 01 and 02. The coefficient matrices are calculated numerically in a noniterative fashion. Maximum likelihood esti-mation is employed to estimate 01 and 02 as well as in a noniterative fashion. Maximum likelihood estimation is employed to estimate 01 and 02 as well as additional parameters from measurements. Linear estimation theory (cokriging) then yields point or estimate of the methodology gives good estimates of transmissivities. When the transmissivities are used in a numerical model they reproduce the head measurements quite well. The developed methodology was applied for the estimation of transmissivities of the Jordon aquifer in Iowa. This case study illustrated that the geostatistical approach can be a useful tool in the iterative process of model development. Model validation serves to diagnose possible conflicts between modeling assumptions and available data and to suggest ways in which these conflicts can be resolved. In the case of the Jordan aquifer, accounting for leakage into the aquifer and removal of two outliers ap-

peared to improve the consistency among modeling assumptions and measurements. (Moore-IVI) W85-02169

CONTAMINANT TRANSPORT IN FRAC-TURED POROUS MEDIA: ANALYTICAL SO-LUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE, Waterloo Univ. (Ontario). Dept. of Earth Sciences. For primary bibliographic entry see Field 5B. W85-02170

2G. Water In Soils

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUBSTANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS,

Michigan Univ., Ann Arbor. Dept. of Civil Engi-

For primary bibliographic entry see Field 5B. W85.01793

NEW MATERIALS IN PIPE NETWORKS -SPECIAL CONSIDERATION OF INTERNAL COATINGS,

Zurich Water Supply (Switzerland). A. Naf.

Aqua, No. 5, p 221-224, 1983. 14 Fig, 1 Tab.

Descriptors: *Corrosion, *Pipelines, *Linings, Pipes, Water conveyance, Water distribution. Pipes, Water conveyance, Cement, Mortar, Linings.

Reliable corrosion protection of metallic pipelines is an important factor in determining the quality of ground installed facilities. Besides the choice of ground installed facilities. Besides the choice of material and insulation, attention must be given to the installation which must be performed in a clean and expert manner. The lining of water pipelines with bitumen is rarely used today. Theoretical perceptions show that the carcinogenic compounds contained in the tar are transferred to the water. Cement mortar lining is not completely impermeable. Water penetrates through the mortar to the pipe wall. The formation of ferric hydroxide, however, results in an essentially increased ide, however, results in an essentially increased bondage. As an alternative solution to the cement bondage. As an alternative solution to the cement mortar lining a Swiss Pipeline product using a synthetic material lining has been developed. Re-sults of tests of pipe strength and resistance to corrosion are discussed along with the manufac-ture of fittings and accessories and tension-proof connections. (Baker-IVI) W85-01997

MICROWAVE MEASUREMENTS OF MOIS-TURE DISTRIBUTIONS IN THE UPPER SOIL PROFILE

Arkansas Univ., Fayetteville. Dept. of Agronomy. A. M. Sadeghi, G. D. Hancock, W. P. Waite, H. D. Scott, and J. A. Rand. Water Resources Research, Vol. 20. No. 7, p 927-934, July, 1984. 10 Fig, 3 Tab, 23 Ref. NASA grant NAG-5-20.

Descriptors: *Soil water, *Microwaves, *Remote sensing, Reflectivity, Tillage, Evaporation, Drying, Soil properties.

Laboratory and field experiments were conducted content near the parimeters were contacted to investigate the ability of microwave remote sensing systems to detect the moisture status of a sit loam soil exhibiting abrupt changes in moisture content near the surface. Laboratory soil profiles content near the surface. Laboratory soil profiles were prepared with a discontinuous moisture boundary in the subsurface. Reflectivity measurements of these profiles were made with a bistatic reflectometer operating over the frequency ranges of 1-2 and 4-8 GHz (wavelength ranges of 30-15 and 7-5-3.75 cm, respectively). These measurements exhibited a well-developed coherent interference pattern in good agreement with a simple two-layer reflectivity model. Field measurements of bare soil surfaces were conducted for initially saturated profiles and continued for extended periods of drying. During drying, coherent interfereds of drying. During drying, coherent interfereds ods of drying. During drying, coherent interference patterns similar to those observed in the labo-

ratory were detected. These appear to be due to steep moisture gradients occurring between drying layers near the surface. The field results were modeled by a five-segment linear moisture profile with one or two steep segments and a multilayer reflectivity program. Agreement between model and field response over the frequency range was used to estimate the depth of drying layers within the soil. These depths were monitored over the second and third drying cycles. Formation of the drying layers under field conditions appears to be influenced by drying time, tillage, and evaporative demand. In any case, it appears that the coherent effects caused by nonuniform moisture profiles may substantially affect the reflectivity of even rough soil surfaces. (Author's abstract)

TRAVEL TIMES FROM BURIED AND SUR-FACE INFILTRATION POINT SOURCES,

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Envi-ronmental Mechanics. ronmental M. J. R. Philip.

Water Resources Research, Vol. 20, No. 7, p 990-994, July, 1984. 3 Fig, 13 Ref.

Descriptors: *Solute transport, *Mathematical equations, *Infiltration, Water pollution sources, Leaching, Soil water, Convection, Diffusion.

A primary element in the analysis of solute trans-port and leaching during steady saturated and un-saturated two- and three-dimensional soil water flows is the time of travel of marked water particles from their source to all downstream points of the flow field. Exact travel time solutions for flows the flow field. Exact travel time solutions for flows of physical interest are clearly of significance. The exact solutions are presented for travel times for three-dimensional steady infiltration into a homogeneous soil from buried and surface point sources. While the study was developed specifically in terms of the quasi-linear analysis of water movement in unsaturated soils, it will be understood that the mathematical results apply to any steady conthe mathematical results apply to any steady con-vection-diffusion process described by an equation of a specified form, together with appropriate boundary conditions. In this sense, the exact soluboundary conditions. In this sense, the exact solu-tions for travel times are presented from continu-ous point sources for all linear convection-diffusion processes in the appropriate infinite and semi-infi-nite regions. The results are presented graphically. In the soil water context a limitation is that travel velocities are based on a mean volumetric moisture content. (Baker-IVI) W85-02167

2H. Lakes

WATER TEMPERATURE AND TURBIDITY IN GLACIALLY FED LAKE TEKAPO, Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst. J. Irwin, and R. A. Pickrill.

New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 2, p 189-200, 1982. 5 Fig, 16

Descriptors: *Lake Tekapo, *New Zealand, *Water temperature, *Turbidity, *Glacial lakes, Glacial streams, Godley River, Thermal stratification, Coriolis force, Isotherms.

Inflow into Lake Tekapo (New Zealand) is dominated by the glacially-fed headwater Godley River. Measurements of water temperature and transmissivity at periods of seasonal maxima and minima provide data on dispersion of river water entering the lake. During spring, lake waters warming from isothermal winter conditions receive turbid cold meltwater which interflows or underflows downslope to the deepest basin to pond against the rising lake floor. Waters stratify weakly in summer, and turbid inflowing water interflows. In winter, near isothermal lake water receives cold clear water underflowing to the deepest basin. In all seasons inflowing water is deflected towards the eastern side of the lake by Coriolis force. Diurnal changes in inflow across the Godley delta in spring are complex, with interflow and overflow

Lakes-Group 2H

influenced by heating of waters flowing over wide, braided river channels. In winter, underflows are strongest in early morning when inflows are coldest, and they weaken through the day as river waters warm. (Author's abstract)
W85-01637.

PREDOMINANT HEADWATER INFLOW AND ITS CONTROL OF LAKE-RIVER INTERACTIONS IN LAKE WAKATIPU,

Department of Scientific and Industrial Research, Wellington (New Zealand). Oceanographic Inst.

Weimigion (tew Zealand). Oceanographic list. R. A. Pickrill, and J. Irwin. New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 2, p 201-213, 1982. 5 Fig. 23 Ref.

Descriptors: *Lake Wakatipu, *New Zealand, *Inflow, Temperature, Suspended solids, Particulate matter, Water temperature, Under flow.

Temperature and suspended particulate matter concentrations were used to identify lake-river interactions in Lake Wakatipu (New Zealand). Results from sampling at seasonal maxima and minima of water temperature and inflow, in conjunction with density estimates, suggest that both annual and diurnal cycles from inflow from the predominant headwaters are generated. From mid autumn to mid spring, underflows predominate; in summer, river water may warm sufficiently to allow inflowing water to interflow or overflow. In summer the large diurnal temperature range in the rivers sets up a diurnal cycle of inflows, with underflow in the early morning, progressing through to interflows and finally overflows again at night. In winter, when river temperatures remain low throughout the day, inflowing water underflows continuously. Floods normally enter as turbid underflows, disrupting the diurnal summer cycle and strengthening the underflows of winter. Flood underflows reach speeds of over 20 cm/s and carry naticulate material over folk m downslows into the derflows reach speeds of over 20 cm/s and carry particulate material over 60 km downslope into the deepest basin. (Author's abstract) W85-01638

SEASONAL MEROMIXIS IN THREE HYPER-SALINE LAKES ON ROTTNEST ISLAND, WESTERN AUSTRALIA,

Western Australia Univ., Nederlands. Dept. of Zo-

ology. S. E. Bunn, and D. H. D. Edward. Australian Journal of Marine and Freshwater Research, Vol. 35, No. 2, p 261-265, 1984. 2 Fig, 1 Tab, 13 Ref.

Descriptors: *Western Australia, *Australia, *Rottnest Island, *Meromictic lakes, *Saline lakes, Stratification, Water temperature, Salinity.

On Rottnest Island, approximately 19 km west of Fremantle, Western Australia, there are six permanent hypersaline lakes; three of the lakes become meromictic 'hot lakes' during winter and spring. These are the first such lakes recorded in Australia. These are the first such lakes recorded in Australia. Monthly temperature profiles were taken from June 1980 to January 1981 and from April to December 1982 in Serpentine Lake. Profiles were also taken in Government House, Herschell, and Bagdad Lakes. An important factor contributing to the transient stratification is a surface input of fresh water from seepages around the lakes, which overlays the existing hypersaline layer. Heat penetrates to the monimolimnion of these clear-water lakes and is trapped by the insulating effect of the overlying less-saline water. The disappearance of the stratification at the onset of summer is thought to be due to reduced freshwater input and evaporation of the less-saline mixolimnion. Stratification was never observed in either of the two shallow salt lakes, Bagdad and Garden; since these lakes also receive freshwater from seepages it is likely that the shallow conditions permit complete mixing throughout the year. (Collier-IVI) W85-01645

DECOMPOSITION OF WILD RICE (ZIZANIA AQUATICA) STRAW IN TWO NATURAL LAKES OF NORTHWESTERN ONTARIO,

Ontario Ministry of Natural Resources, Kenora. Nortwestern Region.

Canadian Journal of Botany, Vol. 62, No. 7, p 1352-1356, July, 1984. 5 Fig, 1 Tab, 25 Ref.

Descriptors: *Ontario, *Rice, *Decomposition, *West Bay, *Lulu Lake, *Nutrients, Nitrogen, Phosphorus, Potassium, Calcium, Sulfur, Magnesium, Carbon.

Decomposition of wild rice (Zizania aquatica L) straw was studied by placing 20 g of air-dried straw into 25 X 15 cm size nylon bags. Each set of five straw bags was covered in a fine aluminum screen to avoid damage from aquatic animals. The screens were placed on October 17, 1979, in West Bay representing a river system and in Lulu Lake, a typical shallow wild rice lake. After 350 days the total decomposition by weight of straw was 94 and 72% in West Bay and Lulu Lake, respectively. Release of nutrients from the straw was studied by calculating the percent loss of nutrients was observed during the first 3 wk followed by a slow release of nutrients thereafter. Total amounts of nutrients released after 350 days were about 98% potassium, 82% calcium, 81% phosphorus, 79% sulfur, 72% magnesium, and 57% nitrogen. The amount of nitrogen released and the carbon-nitrogen ratio of straw at the jointing stage of wild rice suggest that a major portion of the total nitrogen remains tied up in straw and may not become available for the next wild rice crop. (Author's abstract) thor's abstract) W85-01647

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO,

Alberta Univ., Edmonton. Dept. of Botany. D. H. Vitt, and S. Bayley. Canadian Journal of Botany, Vol. 62, No. 7, p 1485-1500, July, 1984. 28 Fig, 5 Tab, 45 Ref.

Descriptors: *Ontario, *Vegetable crops, *Oligotrophic lakes, *Peat bogs, *Mires, Precambrian Shield, Calcium, Conductivity, Hydrogen ion concentration, Mosses, Magnesium, Sulfates, Nitrates,

centration, Mosses, Magnesium, Sulfates, Nitrates, Alkalinity.

Four small oligotrophic basin mires on the Precambrian Shield were quantitatively analyzed for vegetation patterns and surface water and groundwater chemistry. Mean concentrations of ions in the surface waters of all vegetation stands indicate these mires to be characterized by low calcium content (0.6-1.9 mg Ca/L), low corrected conductivity (12-31 micro mho/cm (1 mho = 1 S)), and relatively high pH (4.0-5.7). Mire 224 is dominated by Chamaedaphne callyculata, Scheuchzeria palustris, and Carex oligosperma. The surface water mean determinations are Ca, 1.10 +/- 0.51 mg/L; Mg, 0.57 +/- 0.2 mg/L; corrected conductivity, 16.7 +/- 4.2 micro mho/cm; and pH 4.37. Abundance patterns of the dominant Carex species can be correlated with pH of the surface water of the mire. Mire 239 is characterized by Smilacina trifolia, Ledum groenlandicum, and Carex trisperma. The mean surface water determinations are Ca, 1.53 +/- 0.36 mg/L; Mg, 0.59 mg/L; corrected conductivity, 21.2 +/- 2.0 micro mho/cm; and pH 4.0. Significant differences in pH, Ca, and Mg occur between the interior and edge portions of this bog. Water chemistry from portions burned in 1974 showed no differences from unburned portions. The vegetation of mire 661 contains a sequence of communities positioned relative to the inflow streams, with a Myrica gale - Alnus rugosa community followed by a zone dominated by Picca mariana then a Larix laricina zone and then by an open Sphagnum papillosum - Menyanthes trifoliata lake edge zone. More ombrotrophic areas are dominated by Sphagnum fuscum. Ca, Mg, and Fe concentrations, pH, and corrected conductivity were reduced through this sequence. Comparison of weekly samples of water entering and leaving this mire in 1981 showed a reduction of Ca, Mg, SO4, NO3 N, alkalinity, and pH. (Author's abstract) stract) W85-01648

VERTICAL TEMPERATURE DISTRIBUTION

National Bureau of Standards (NEL), Boulder, National Bureau of Standards (NEL), Boulder, CO. Center for Chemical Engineering. R. D. Noble, N. J. Kemp, and R. G. Buschman. Journal of Environmental Systems, Vol. 14, No. 1, p 63-75, 1984-85. 2 Fig. 15 Ref, 1 Append.

Descriptors: *Water temperature, *Vertical distri-bution, *Lakes, *Solar radiation, Heat transfer, Model studies, Air-water interface, Thermal strati-

Analytical expressions for the vertical temperature Analytical expressions for the vertical temperature distribution in large lakes and other large water bodies are not available for the general case. This is due in large measure to two problems: there are non-linearities in the heat exchange term at the airwater interface and the actual absorbed radiation at the air-water interface has been difficult to express exploried in the control of the water interface and the actual absorbed radiation at the air-water interface has been difficult to express analytically. Analytical solutions were developed for the vertical temperature distribution in lakes. The solutions are good for large water bodies where inflows and outflows are negligible. The solution is based on a linearization of the surface heat exchange term. Solutions were developed for both zero-order and first order linearizations. An analytical expression was used to describe the actual daily absorbed radiation at the air-water interface. Since the model can account for variations in incoming solar radiation over time, the model could be very useful for estimating the vertical temperature distribution over extended periods. It would also be useful as a check on numerical solutions and a check on limiting cases of surface heat exchange. The model contains no adjustable parameters. Based on comparisons with experimental data, the model predictions become better as one approaches the end of the averaging period for the surface heat loss values. (Collier-IVI) W85-01651

INFLUENCE OF PHYSICO-CHEMICAL FAC-TORS ON THE COLIFORM BACTERIA IN A CLOSED-LAKE WATER SYSTEM.

Jawaharlal Nehru Univ., New Delhi (India). Mi-

Jawaharlai Nehru Univ., 1968 2018
U. S. Bagde, A. M. Khan, and A. K. Varma.
International Journal of Environmental Studies,
Vol. 18, No. 3/4, p 237-241, 1982. 7 Fig, 16 Ref.

Descriptors: *Physicochemical properties, *Coliforms, *New Delhi, *India, Nutrient requirements, Bacteria, Nitrogen, Phosphates, Hydrogen ion concentration, Conductivity, Water temperature, Hardness, Sulfates, Ammonia, Nitrates, Nitrites.

Correlation of physical and chemical factors with biological factors has not been included in most research on heterotrophic pathogenic coliform bacteria. During the hot and humid period of May to August, epidemic diseases caused by coliform organisms are commonly reported in northern India. The coliform group of micro-organisms responsible for causing pollution in drinking waters was examined in a lake on the East-North of New Campus of Jawaharlal Nehru University, New Delhi. Bacterial counts (MPN) were correlated with certain physical and chemical factors, vizelectrical conductivity, pH, temperature, Ca-Mg hardness, inorganic nitrogen substances, inorganic sulfate and phosphate contents of the water. The coliform counts (MPN) varied with seasonal variations and changes in the properties of the water bodies. An inverse correlation of bacterial counts was noted with the dissolved inorganic nitroge-Correlation of physical and chemical factors with bodies. An inverse correlation of outcernal counters was noted with the dissolved inorganic nitroge-nous compounds like ammonia, nitrite and nitrate. Similar observations were made when compared with dissolved salts of phosphate and sulfate. (Collier-IVI) W85-01672

OXYGEN DEPLETION IN CENTRAL AND EASTERN LAKE ERIE: RELATIONSHIP WITH BACTERIA, CHLOROPHYLL, POC, AND MORPHOMETRY, National Water Research Inst., Burlington (Ontar-

M. N. Charlton, and S. S. Rao.

Field 2—WATER CYCLE

Group 2H-Lakes

Journal of Great Lakes Research, Vol. 9, No. 1, p 3-8, 1983. 2 Fig. 3 Tab, 16 Ref.

Descriptors: *Lake Erie, *Oxygen depletion, *Bacteria, *Chlorophyll, *Organic carbon, Lake morphology, Hypolimnion, Particulates, Metabolism, Lake sediments.

Hypolimnion oxygen depletion in central and eastern Lake Erie was related to bacteria, particulate
organic carbon, and chlorophyll concentrations
during 1979. The central basin had the higher
oxygen depletion rate and this was associated with
more microbiota and particulate organic carbon.
After compensation for temperature differences,
the rate of oxygen depletion per unit bacteria,
chlorophyll, and particulate organic carbon was
found to be similar in each basin. These observations are consistent with hypothesis that lake morphometry affects oxygen depletion through the
control of hypolimnion particle concentrations.
The implication that most of the hypolimnion
oxygen metabolism occurs in the water column
means that the role of sediments as a site of oxygen
consumption should be reassessed. (Author's abwrs.0152

ROLE OF SEDIMENTS IN THE NITROGEN BUDGET OF LOWER GREEN BAY, LAKE MICHICAN

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab. For primary bibliographic entry see Field 5B. W85-01754

ASSOCIATION BETWEEN NET BASIN SUP-PLIES TO LAKE SUPERIOR AND SUPPLIES TO THE LOWER GREAT LAKES,

Wisconsin Univ.-Madison. Dept. of Geography. W. A. R. Brinkmann. Journal of Great Lakes Research, Vol. 9, No. 1, p 32-39, 1983. 5 Fig, 4 Tab, 13 Ref.

Descriptors: *Great Lakes, *Lake Superior, *Water level, *Hydrologic budget, Eigenvector analysis, Precipitation, Water supply.

Eigenvector analysis was carried out on monthly net basin supplies for the Great Lakes for the period of 1900-1973. Net basin supply anomalies for Lake Superior are to a large degree uncorrelated with those for the lower three lakes. There is a certain degree of opposition in the sign of the anomalies, particularly in the moderate range of net basin supplies. Extreme magnitudes (exceeding one standard deviation for at least part of the system) are almost always of the same sign. This suggests that the use of Lake Superior as a storage reservoir, in the absence of reliable long range weather predictions, is of some benefit during periods of moderate net basin supplies only, because periods of prolonged severe events tend to be basin-wide. Variations in the time series of the eigenvector coefficients suggest that, in general, supplies tended to be above average for the low lakes until about the 1930s and again since the mid 1960s, and that supplies tended to be above average for Lake Superior during the 1940s and 1950s. These times of change are in agreement with the timing of shifts in large scale circulation patters for the Northern Hemisphere as well as for eastern North America and with the times of change in temperature and precipitation patterns over the Great Lakes region. (Baker-IVI)

INFLUENCE OF THE ST. MARYS RIVER PLUME ON NORTHERN LAKE HURON PHYTOPLANKTON ASSEMBLAGES, Michigan Univ., Ann Arbor. Great Lakes Research Div.

R. G. Kreis, Jr., T. B. Ladewski, and E. F.

Stoermer.
Journal of Great Lakes Research, Vol. 9, No. 1, p 40-51, 1983. 6 Fig, 2 Tab, 34 Ref.

Descriptors: *St. Marys River, *Lake Huron, *Phytoplankton, Distoms, Entrainment, Plumes, Water circulation, Suspended sediments, Sinking, Chlorophyll a, Benthic flora.

Analysis of phytoplankton samples from the Straits of Mackinac region yielded high species diversity and species richness values at the outfall of the St. Marys River due to entrained benthic diatoms. Epilithic, psammonic, epipelic, and epiphytic diatoms originating in the St. Marys River and Detour Passage area were removed from their primary habitats and transported into northern Lake Huron. Southward movement of the St. Marys River plume, as determined from suspended benthic diatom distribution and abundance, was strongly indicated for 3 km. Moderate influence of the plume was noted at 6 km and weaker association with the plume was detected for as far as 32 km. Apparently, loss of suspended riverine species from the upper water column in this area was primarily due to sinking. Sinking, calculated from residence times based on river discharge data, was estimated to range between 0.76 and 5.99 m/day. Total phytoplankton abundance and chlorophyll a values were lower near the rivermouth. Conversely, C-14 uptake was significantly greater near the river. Benthic populations comprised as much as 40% of the assemblage and an additional amount of dead and fragmentary diatoms was also observed. Viable benthic diatoms may contribute as much as 25% of the algal assemblage on a cell volume basis. Upon death and decomposition, they may constitute an important source of carbon and nutrients in the immediate vicinity. (Author's abstract)

SPECTRAL ATTENUATION AND IRRADIANCE IN THE LAURENTIAN GREAT LAKES, National Water Research Inst., Burlington (Ontario). Aquatic Physics and Systems Div. J. H. Jerome, R. P. Bukata, and J. E. Bruton. Journal of Great Lakes Research, Vol. 9, No. 1, p 60-68, 1983. 7 Fig. 1 Tab, 9 Ref.

Descriptors: *Great Lakes, *Optical properties, *Spectral attenuation, *Irradiance, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Productivi-

The optical characteristics of the Laurentian Great Lakes range from the clearest waters of the upper lakes (Lake Superior, Lake Huron/Georgian Bay) to the turbid waters of the lower lakes (Lake Eric and Lake Ontario). It is these optical characteristics that determine the quantity and quality of radiation that is available for photosynthesis at a giver depth. Optical data collected between 1973 and 1979 are utilized to study spectral attenuation and irradiance in the midlake waters of the four Great Lakes. Particular attentuation is given to the photosynthetic available radiation (PAR), its incident spectral distribution, its spectral attenuation, and its qualitative change with depth. Curves are shown illustrating these spectral properties as well as the relationships between PAR and the photosynthetic usable radiation (PUR) for each of the lakes. These curves, along with the included mathematical relationships, enable quantitative estimates to be obtained of nicident PAR, subsurface PAR, and subsurface PUR, and qualitative information to be obtained or subsurface irradiance levels for the Laurentian Great Lakes. Lake Superior and Lake Huron/Georgian Bay, in general, display similar and comparable optical characteristics, as do Lakes Eric and Ontario. The optical characteristics of the upper Great Lakes, however, are quite distinct form those of the lower Great Lakes. These similarities and differences between the Laurentian Great Lakes are a direct consequence of the levels of productivity, with the upper Great Lakes being characterized by higher productivity and the lower Great Lakes being characterized by higher productivity. (Moore-IVI)

PREDICTING VARIABILITY IN A LAKE ON-TARIO PHOSPHOROUS MODEL,

Michigan State Univ., East Lansing. Dept. of Resource Development.
R. H. Montgomery, V. D. Lee, and K. H.

Journal of Great Lakes Research, Vol. 9, No. 1, p 74-82, 1983. 5 Fig, 2 Tab, 25 Ref. NOAA grant 03-78-B01-109.

Descriptors: *Lake Ontario, *Phosphorus, *Model studies, Variability, Prediction, Error analysis, Monte Carlo method, Uncertainty.

The prediction of a model always has a degree of uncertainty. Because the level of uncertainty is inversely related to the value of information contained in the prediction, there is a need to quantify the uncertainty. One approach to estimate prediction uncertainty is first-order error analysis. In this method, the error in a characteristic (variable or parameter) is defined by its first nonzero moment (the variance). Errors are propagated through the model using first-order terms in the Taylor series, and the variances are then combined to yield the total prediction uncertainty. An alternative approach to model prediction error analysis is Monte Carlo simulation. In this technique, probability density functions are assigned to each characteristic (variable or parameter), reflecting the uncertainty in that characteristic. Then, values are randomly selected from the distribution for each term and inserted into the model, to calculate a prediction. Repeating this process a number of times produces a distribution of predicted values, which reflects the combined uncertainties. These two approaches (first-order error analysis and Monte Carlo simulation) are applied to Lake Ontario data using a steady state mass balance phosphorus model. Comparisons are made which suggest guidelines for the use of each. (Author's abstract) W85-01758

NET ATMOSPHERIC INPUTS OF PCBS TO THE ICE COVER ON LAKE HURON,

De Paul Univ., Chicago, IL. For primary bibliographic entry see Field 5B. W85-01759

SATELLITE-TRACKED CURRENT DRIFTERS IN LAKE MICHIGAN,

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.

For primary bibliographic entry see Field 7B. W85-01760

RELEASE OF SEDIMENT-PHOSPHORUS AND THE INFLUENCE OF ALGAL GROWTH ON THIS PROCESS

ON THIS PROCESS, Amsterdam Univ. (Netherlands). Lab. voor Microbiologie.

L. Van Liere, J. Peters, A. Montijn, and L. R. Mur.

Hydrobiological Bulletin, Vol. 26, No. 2-3, p 191-200, December, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Phosphorus, *Lakes, *Netherlands, *Algal growth, *Sediments, Polders, Eutrophication, Lake sediments.

A Continuous Phosphorus Release Reactor was used to measure the rate of phosphorus release from undisturbed sediment cores taken from several lakes and polders in the province of North-Holland. Findings from various lakes and polder ditches were compared with each other. Peaty lakes exchanged their particulate phosphorus rapidly with the overlying water as compared with other sediment types. This makes them suitable for phosphorus load reduction measures. There was found to be no simple direct relation between chemically extracted phosphorus fractions and the phosphorus released during the experiment. Algal growth in the overlying water stimulated the release of phosphorus. (Baker-IVI)

WIND INDUCED DIFFUSION IN A SHALLOW LAKE, A CASE STUDY,

Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology. J. D. Leenen. Descriptors: *Shallow water, *Wind, *Diffusion, Lakes, Limnology, Mixing, Mathematical equations, Tracers.

The longitudinal mixing process in a shallow lake under the influence of wind has been studied. This process may be described with the classical convection-diffusion equation. A time scale for vertical mixing of about 6 hours was found, which is small compared to the time scale for horizontal mixing of several weeks. This is the reason that vertical mixing is negligible compared to the horizontal transport. A formula is given for estimating the longitudinal diffusion coefficient. The formula shows more differentiation than a previously developed empirical formula. Using a numerical model to describe the transport of chloride (a naturaly available tracer in this lake) the diffusion coefficient has been calibrated. Results agree favorably with the dimensional estimate and the above mentioned empirical formula. The hypothesis is stated that the macrocirculation pattern depends on the wind direction, and that the lengthscale in the horizontal, wind induced diffusion process should be associated with the size of the macro-eddies and not with the size of the lake. (Baker-IVI)

LIMNOLOGY IN RESERVOIRS ON THE COL-

LIMNOLOGY IN RESERVOIRS ON THE COL-ORADO RIVER,
Nevada Univ., Las Vegas. Lake Mead Limnologi-cal Research Center.
L. J. Paulson, and J. R. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190164, Price codes: Al 3 in paper copy, A01 in microfiche. Technical Report No. 11, September 1983. 269 p, 52 Fig. 3 Tab, 65 Ref, 1 Append. Project No. OWRT B-121-NEV(1), Contract/Grant No. 14-34-0001-1243.

Descriptors: Water quality management, Water quality, *Limnology, *Nitrogen, *Phosphorus, *Chlorophyll, *Productivity, *Nutrients, *Colorado River, Lake Powell, Lake Mead, Lake Mohay, Lake Havasu, Nevada, Arizona, Utah, California.

The most prevalent limnological characteristic of the Colorado River reservoirs during 1981 and 1982 was the low phosphorus concentrations that existed in most of the systems. A large percentage of the phosphorus inputs to the reservoirs from the tributaries and main stem was bound to suspended sediments. This was especially evident in Lake Powell where over 90% of the total and biologically available phosphorus inputs were sedimented (retained) in the reservoir. Total nitrogen concentration in the reservoirs decreased downstream from the headwaters of Lake Powell. This decrease was caused by nitrogen retention in each from the headwaters of Lake Fowel. Inis de-crease was caused by nitrogen retention in each reservoir and by the lack of significant nitrogen inputs from downstream tributaries. The reservoirs were all phosphorus limited on the basis of areaweighted, annual average total nitrogen/total phosphorus (TN/TP) ratios. The ratio does decrease downstream reflecting the slight increase in phosphorus and decrease in nitrogen; however, the average annual TN/TP ratios never approached levels where nitrogen would be considered limiting. W85-01812

HYDROLOGY OF LAKE PADGETT, SAXON LAKE, AND ADJACENT AREA, PASCO COUNTY, FLORIDA, Geological Survey, Lakewood, CO. Water Re-

For primary bibliographic entry see Field 7C. W85-01826 sources Div

TROPHIC ECOLOGY OF FISH REARING

PONDS, Ohio State Univ., Columbus. Dept. of Zoology. R. M. Vaga, and D. A. Culver. Available from the National Technical Information Avanuore from the National Technical Information Service, Springfield, VA 22161 as PB84-207331, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center Completion Report, March, 1984. 81 p. 21 Fig. 5 Tab, 47 Ref. Project No. OWRT A-065-OHIO(1).

Descriptors: *Plankton, *Zooplankton grazing, Phytoplankton, Algae, Larval fish, Productivity, Bacteria, Nutrients, Population dynamics, *Ohio, Hebron National Fish Hatchery, *Trophic dynamics, *Fish yield, *Trophic levels, Ecology.

A three year study of the trophic dynamics of fish rearing ponds was conducted at the Hebron National Fish Hatchery, Hebron, Ohio to investigate questions concerning the interaction of various trophic levels in the plankton and to better understand the factors most responsible in determining fish yield. Investigation of the effects of zooplankton gesting on the give structure of the phytoplank stand the factors most responsible in determining fish yield. Investigation of the effects of zooplankton grazing on the size structure of the phytoplankton indicated that above certain threshold levels of zooplankton biomass, zooplankton grazing can radically change the size structure of the phytoplankton community. Small flagellates were susceptible to both Daphnia and Bosmina grazing whereas small cryptomanads were removed only by Daphnia. The dynamics of resistant algal forms to grazing was not possible to predict at the species level. The presence of filament concentrations in excess of 20% of total phytoplankton volume inhibited the egg production of Daphnia more than that of Bosmina. However, total seasonal reproductive output of both species was due to factors other than filament concentration and the effects of filaments on succession in the zooplankton is questioned. Fish predation was found to affect the percapita production of Daphnia and to have a large influence on the species composition of the zooplankton community. High levels of fish predation resulted in Bosmina becoming the dominant grazer but at the same time increased the reproductive rate in Daphnia, regardless of species.

STUDY OF HABITAT CONDITIONS OF THE MACROPHYTIC VEGETATION IN SELECTED RIVER SYSTEMS IN WESTERN LOWER SAXONY (FEDERAL REPUBLIC OF GERMA-

NY), Oldenburg Univ. (Germany, F.R.). Dept. of Biol-

Aquatic Botany, Vol. 18, No. 4, p 313-352, June, 1984. 3 Fig, 8 Tab, 99 Ref.

Descriptors: *Macrophytes, *Aquatic habitats, *Rivers, *Lower Saxony, *West Germany, Ecological distribution, Marshes, Vegetation, Analysis of variance, Cluster analysis, Aquatic plants, Dissolved oxygen, Turbidity, Velocity, Acidity, Calci-

In Lower Saxony, ecological investigations were carried out in selected river systems. The vegetation of the 43 sampling sites was classified by means of cluster analysis into 7 groups, 3 of which occurred on the diluvial plains and 2 in the coastal means of cluster analysis into 7 groups, 3 of which occurred on the diluvial plains and 2 in the coustain marsh area only. Forty-one parameters were measured 3-7 times covering 2 vegetation periods. The structure of the data was carefully studied by bivariate correlation analysis and factor analysis. A high number of significant correlations was detected, which indicates difficulties in ecological interpretation. Temporal variation of the parameters measured was classified into 3 groups according to stability. For a study of the relationships between the vegetation and the ecological parameters, the data set was split into 5 subsets (physical data, water chemical data, intersitial water chemical data, settiment characteristics, and a mixed set of simple field data). The relationship of each subset to the vegetation was studied separately using cluster analysis. The mixed data set FIELD showed the highest degree of similarity to the vegetation qualities were shown by some physical and water chemical parameters (oxygen content, turbidity, current velocity, acidity, calcium). The ecological behavior of some species of medium frequency was also studied in detail by means of analysis of variance. The means of all parameters for occurrence and non-occurrence were compared. For Ranunculus peltatus, Myriophyllum alterniforum and Elodea canadensis, several differentiation variables could be detected. The zonation of two rivers was studied in detail by comparing the vegetation sequence with important physical and chemical parameters in the cological parameters for occurrence were compared.

rameters. The interaction between these parameter groups is clearly shown. Physical parameters like current velocity are responsible for the basic zonation, while chemical parameters can modify the zones to a large extent. (Moore-IVI) W85-01887

FACTORS STRUCTURING FISH ASSEMBLAGES ALONG A BOG LAKE SUCCESSIONAL GRADIENT,

Wisconsin Univ.-Madison. Center for Limnology.

Ecology, Vol. 65, No. 4, p 1276-1289, August, 1984. 3 Fig, 8 Tab, 71 Ref.

Descriptors: *Fish, *Bog lakes, *Succession, *Wisconsin, Oligotrophic lakes, Multivariate analysis, Hydrogen ion concentration, Dissolved oxygen, Minnows, Perch, Acid lakes.

Three alternate and distinct fish assemblages were Three alternate and distinct fish assemblages were identified in 43 northern Wisconsin lakes encompassing a gradient from bog ponds to small, oligotrophic lakes having little bog character. Multivariate analysis of physical/chemical variables identified three general environmental factors that influence community type and species richness. These factors are: (1) habitat size and heterogeneity; (2) lake productivity-pH; and (3) winter oxygen concentrations. Ordination of lake fish assemblages along these environmental radients revealed that two factors, lake pH and winter anoxia, were especially crucial in determining assemblage type. Maintenance of these discrete assemblage type.

Maintenance of these discrete assemblages is also the result of biotic interactions (exclusion of cy-Maintenance of these discrete assemblage is also the result of biotic interactions (exclusion of cyprinids due to predation or competition from centrarchids). A centrarchid assemblage dominates lakes across a wide range of habitat types and pH, providing winter anoxia does not occur. Lakes with low winter oxygen concentrations harbor a cyprinid assemblage if the pH is above 5.2-5.4. Lakes that are acidic and also have low winter oxygen contain only two physiologically hardy species comprising the Umbra-Perca assemblage: central mudminnow (Umbra limi) and yellow perch (Perca flavescens). Five fishless lakes had physical and chemical characteristics similar to lakes with an Umbra-Perca assemblage. Within the fish assemblages, no subgroups of closely associated species were evident. For Umbra-Perca lakes, few environmental differences were evident between lakes having (1) no fish, (2) central mudminnows only or, (3) yellow perch and central mudminnows. The sequential loss of species along a gradient from oligotrophic seepage lakes to bog ponds reflected the increased harshness of the chemical environment and the loss of near-shore habitat zones. Species that are specialized zooplanktivores, that utilize hard-bottom substrates for spawning or feeding activities, or that are intolerant of low pH were limited to lakes with little bog character. Lakes in intermediate stages of sucescence contained only yellow perch and central mudminnows. The location of bog lakes at the lower end of several environmental gradients makes them valuable sites for studying the influence of environmental factors and biotic interactions on the structure of aquatic communities. (Author's abstract)

PHYTOPLANKTON POPULATION DYNAMICS OF A SMALL RESERVOIR: EFFECT OF INTERMITTENT MIXING ON PHYTOPLANKTON SUCCESSION AND THE GROWTH OF BLUE-GREEN ALGAE,

McMaster Univ., Hamilton (Ontario). Dept. of Bi-A. M. Trimbee, and G. P. Harris.

Journal of Plankton Research, Vol. 6, No. 4, p 699-713, 1984. 7 Fig. 2 Tab, 26 Ref.

Descriptors: *Phytoplankton, *Population dynamics, *Succession, *Algal growth, *Guelph Lake, *Ontario, Reservoirs, Cyanophyta, Diatoms, Seasonal variation, Anoxic conditions, Seasonal suc-

Field 2-WATER CYCLE

Group 2H-Lakes

The seasonal succession of the phytoplankton of a small reservoir (Guelph Lake, Ontario) in the spring-summer of 1982 was compared to that in spring-summer of 1982 was compared to that in 1981. Mixing of the deeper waters occurred several times throughout the summer in 1982 but not in 1981. The water at 10 m became anoxic for only 2 weeks in late July in 1982. In contrast, in 1981, the weeks in late July in 1982. In contrast, in 1981, the water at 10 m became anoxic at the beginning of July and remained so until mid-September. The phytoplankton dynamics observed in 1982 did not follow the typical progession from spring diatoms to summer species adapted to survive under stratified conditions, as in 1981. Diatoms were present throughout the summer in higher amounts in 1982 than in 1981. The most obvious difference in the type summers was the much greater abundance of two summers was the much greater abundance of Aphanizomenon flos-aquae in 1982. Other bluegreen algae including Microcystis aeruginosa, Gomphosphaeria lacustris, and Lyngbya birgei appeared earlier on in 1982, but did not immediately increase in abundance as in 1981. In 1982 rates of se in abundance as in 1981. In 1982, rates of increase in abundance as in 1981. In 1982, rates of phytoplankton community change were low in May and June and increases were observed in mid-July, early August, late August and late September. In contrast, in 1981, the rate community change increased in late May, mid-June, early July and late July and remained low throughout August and September. (Author's abstract)

WATER QUALITY OF LAKE ARLINGTON ON VILLAGE CREEK, NORTH-CENTRAL TEXAS,

Geological Survey, Austin, TX. Water Resources

F. L. Andrews, and W. J. Gibbons. Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigation Report 83-4196, 1983. 126 p, 18 Fig. 28 Tab, 14 Ref.

Descriptors: *Water quality, *Dissolved oxygen, Iron, Manganese, Nitrogen, Phosphorus, *Dissolved solids, Chloride, Sulfate, Hardness, Phytoplankton, *Texas, Lake Arlington, Village Creek, Thermal stratification.

Water in Lake Arlington on Village Creek in north-central Texas had volume-weighted average concentrations well below secondary maximum contaminant levels for drinking water for dissolved solids, dissolved chloride, and dissolved sulfate. The water was moderately hard. Thermal stratification in Lake Arlington usually begins during March or April and persists until October. Thermal stratification has resulted in significant season-al and areal variations in the concentration of mal stratification has resulted in significant season-al and areal variations in the concentration of dissolved oxygen, dissolved iron, dissolved manga-nese, total inorganic nitrogen, and total phospho-rus. Even through heated effluent from an electri-cal generating plant is returned to the reservoir at site C sub C and cause an elevation of water temperature, average dissolved oxygen levels at this site are not significantly different from levels at other sites. Dissolved iron and dissolved manga-nese were maximum during summer stagnation at nese were maximum during summer stagnation at site A sub C, a deep site near Arlington Dam. The concentrations of dissolved iron and dissolved manganese in water throughout the reservoir during winter circulation and in water near the reservoir surface during summer stagnation were quite low (less than 50 micrograms per liter). (USGS) W85-02042

BOTTOM DYNAMICS IN LAKES,

National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab. For primary bibliographic entry see Field 2J.

ENTRAINMENT, DEPOSITION, AND TRANS-PORT OF FINE-GRAINED SEDIMENTS IN

California Univ., Santa Barbara. Dept. of Mechani-cal and Environmental Engineering. For primary bibliographic entry see Field 2J.

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,

National Water Research Inst., Winnipeg (Manito

E. D. Ongley, M. C. Bynoe, and J. B. Percival. Hydrobiologia, Vol. 91, p 41-57, July, 1982. 9 Fig, 1 Tab, 64 Ref.

Descriptors: *Wilton Creek, *Ontario, *Suspended solids, *Physicochemical properties, *Geochemistry, Storm runoff, Seasonal variation, Particle size, Calcium, Phosphorus, Magnesium, Aluminum, Titanium, Iron, Pottasium, Algae, Bioaccumulation.

To understand the nature of sediment-associated nutrient and contaminant transport dynamics in fluvial systems, a stormflow sampling program of suspended solids is reported for one water year in a representative rural diffuse source catchment of southeastern Ontario. Bulk samples of subsieve suspended solids were obtained using field-portable continuous-flow centrifuge apparatus. The physical and geochemical properties of suspended solids show no significant intersite differences over reaches of 1,500-2,000 m, yet display distinctive seasonal trends. Systematic seasonal changes in particle size, organic content, and Ca, P, Mn, Al, Ti, Fe, and K appear to reflect the changing role of partial area hydrology. Ca, P, and Mn are bioaccumulated by stream algae. Mineral signature is relatively constant over the year. (Author's abstract) W85-02056

COMPARISON OF SEDIMENT ENERGY-TEX-TURE RELATIONSHIPS IN MARINE AND LA-CUSTRINE ENVIRONMENTS,

Canada Centre for Inland Waters, Burlington (On-

For primary bibliographic entry see Field 2J. W85-02058

GEOCHEMISTRY OF THE RHINE AND THE RHONE AND HUMAN IMPACT (LA GEOCHI-MIE DU RHIN ET DU RHONE ET L'IMPACT

Centre d'Ecologie de Camargue (France). Hydrobiologia, Vol. 91, p 85-91, July, 1982. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Rhine River, *Rhone River, *Switzerland, *Geochemistry, Stream pollution, Water pollution, Environmental effects, Water quality.

The Rhine and the Rhone are two rivers very similar in their geological, hydrological and (geo)chemical characteristics. They originate from adjacent glaciers (in Switzerland); both pass through a limestone area and then through a deep lake, which collects most of the glacial silt. Both flow for a further 1 000 km while acquiring, more and more, the character of a lowland river. The chemistry of the water and the suspended matter was originally identical. On each, however, the influence of cultural development has been quite different. It is suggested that a detailed chemical destription of both river systems will be helpful to understand and reduce present-day pollution; very probably, to some extent, both rivers can serve as each other's baseline data. (Author's abstract) W85-02059

WHOLE-LAKE LEAD BURDENS IN SEDI-MENTS OF LAKES IN SOUTHERN ONTARIO, CANADA,

Ontario Ministry of the Environment, Rexdale. For primary bibliographic entry see Field 5B. W85-02062

HISTORICAL CHANGES IN ANTHROPOGENIC LEAD FALLOUT IN SOUTHERN ONTAR-

Trent Univ., Peterborough (Ontario). For primary bibliographic entry see Field 5B. W85-02063 BASIC CONCEPTS AND ASSOCIATED STA-TISTICAL METHODOLOGY IN THE GEO-CHEMICAL STUDY OF LAKE SEDIMENTS, Geneva Univ. (Switzerland). Inst. F.-A. Forel. For primary bibliographic entry see Field 2J. W85-02064

ZINC IN WATER AND SEDIMENTS OF TWO FINNISH LAKES.

Tampere Univ. of Technology (Finland). For primary bibliographic entry see Field 5B. W85-02065

CARBON FLOW ACROSS THE SEDIMENT-WATER INTERFACE IN LAKE VECHTEN, THE NETHERLANDS,

Limnologisch Inst., Nieuwersluis (Netherlands). Limnologisch Inst., Neuweraus (Venterlands). T. E. Cappenberg, K. A. Hordijk, G. J. Jonkheer, and J. P. M. Lauwen. Hydrobiologia, Vol. 91, p 161-168, July, 1982. 4 Fig. 2 Tab, 20 Ref.

Descriptors: *Lake Vechten, *Netherlands, *Carbon, *Sediment-water interface, *Cycling nutrients, Organic matter, Chlorella, Algae, Chlorophyta, Isotope studies, Lakes.

phyta, Isotope studies, Lakes.

The turnover and exchange rates, as well as the diffusion processes, concerning the input and output of carbon compounds at the mud-water interface, were studied. The carbon input rates were derived from the annual sedimentation rates of particulate organic matter (about 1,100 kg C/yr). The nature of the sedimented POC, and its breakdown pathways and turnover rates towards important metabolic intermediates in methanogenesis, were examined. The breakdown kinetics of Chlorella cell walls, a dominant green alga in Lake Vechten, was studied using U and C-14 labelled cell walls. The breakdown of the cell walls appears to be the rate-limiting step in anaerobic mineralization. Using first order kinetic equations, and HPLC and GLC and radio-chemical methods, turnover rate constants (k-values) of between 0.18 and 0.32/day and pool sizes of algal cell walls of 37 to 80 ug/g wet mud were found, giving turnover rates of 7.7 to 25.6 ug/g/day of cell wall material. The turnover rates (k-values between 0.07 and 0.31/h) of acetate, the most important breakdown product, and its concentration gradients (between 5 and 30 micromol) and diffusion coefficient (Ds = 0.0000022 sq cm/s) just in and above mud-water interface, was quantified. The diffusion of acetate, within the sediments, could not account for the turnover rates observed. Finally, from acetate flux data and from those on the rates of formation of carbon dioxide and methane, the output of carbon and its cycling in Lake Vechten are discussed. carbon dioxide and methane, the output of carbon and its cycling in Lake Vechten are discussed. (Author's abstract)
W85-02066

LOADING CONCENTRATION MODELS FOR PHOSPHATE IN SHALLOW LAKES.

Centre d'Ecologie de Camargue (France). H. L. Golterma Hydrobiologia, Vol. 91, p 169-174, July, 1982. 2 Fig, 3 Tab, 9 Ref.

Descriptors: *Phosphate, *Load distribution, *Loading concentration models, *Lakes, *Shallow water, Model studies, Calcium, Apatite, Iron, Lake sediments, Eutrophic lakes, Algal growth.

In shallow lakes, the quantitative influence of sediments on the phosphorous loading is different from that in deep lakes because through resuspension, the sediments are repeatedly brought into contact with the water. A theoretical mathematical formula was developed which describes the phosphate concentration in water and sediments of shallow lakes as a function of loading. In vitro experiments agreed, in principle, with the expected shape of the relationship curve. The curve shows that the phosphate concentration rises slowly during the early reationsing curve. The curve shows trait the pros-phate concentration rises slowly during the early stages of eutrophication and that, later, a much more rapid increase can be expected. In the inter-sitial waters of shallow lake sediments lower pH values may occur than in the overlying water, and iron may control the phosphate concentrations

Lakes-Group 2H

there. As algal growth takes place in the water, in most eutrophic shallow lakes, the Ca(2+) concentration and the pH will control the solubility of the phosphate surrounding these algae. The apatite system is just as important as Fe as a eutrophic-hard-water phosphate controlling mechanism. (Collier-IVI) w85.07067 W85-02067

MODEL FOR INSTREAM REGULATION OF RADIOISOTOPES AND HEAVY METALS IN RIVERINE WATERS SUBJECTED TO A URA-NIUM MILL DISCHARGE,

Beak Consultants Ltd., Mississauga (Ontario). For primary bibliographic entry see Field 5B. W85-02068

EXPERIMENTAL MEASUREMENT OF SEDI-MENT NITRIFICATION AND DENITRIFICA-TION IN HAMILTON HARBOUR, CANADA, McMaster Univ., Hamilton (Ontario). A. Klapwijk, and W. J. Snodgrass. Hydrobiologia, Vol. 91, p 207-216, July, 1982. 6 Fig, 8 Tab, 6 Ref.

Descriptors: *Hamilton Harbour, *Ontario, *Sediments, *Nitrification, Nitrogen cycle, Effluents, Ammonia, Carbon, Sediment-water interface, Arrhenius activation energy, Lakes.

This research examines the role of seumens managed cation and denitrification in the nitrogen cycle of Hamilton Harbour. The Harbour is subject to large ammonia and carbon loadings from a waste-water treatment plant and from steel industries. Spring This research examines the role of sediment nitrifinmonia concentrations rapidly decrease fro ammonia concentrations rapidly decrease from 4.5 to 0.5 mg/L, while spring nitrate concentrations increase from 1 to 2 mg/L, by mid-summer. A three-layer sediment model was developed. The first layer is aerobic; in it, oxidation of organics and nitrification occurs. The second layer is for approaching the contraction and the third layer is for approaching the contraction and the third layer is for approaching the contraction and the third layer is for approaching the contraction and the third layer is for approaching the contraction and the third layer is for approaching the contraction and the third layer is for approaching the contraction and the contracti first layer is aerobic; in it, oxidation of organics and nitrification occurs. The second layer is for and centrification, and the third layer is for anaerobic processes. Ammonia sources for nitrification include diffusion from the water column, sources associated with oxidation of organics, sources from denitrification and from anaerobic processes. Diffusion of oxygen, ammonia and nitrate across the sediment-water interface occurs. Temperature effects are modelled using the Arrhenius concept. A combination of zero-order kinetics for nitrate or ammonia consumption with diffusion results in a half-order reaction, with the respect to the water column loss rate of sediments. From experimental measurement, the rate of nitrification is 200 mg N/L sediment per day, while that of denitrification is 35 mg N/L sediment per day at 20 degrees C. The Arrhenius activation energy is estimated as 15 000 cal/mole-K and 17 000 cal/mole-K for nitrification and denitrification, respectively between 10 degrees C and 20 degrees C. Calculations of the flux of ammonia with the sediments, using the biofilm, compare favorably with experimental observations. The ammonia flux from the water column is estimated to account for 20% of the observed decreased in water column stocks of ammonia, while the nitrate flux from the water column is estimated to account for 25% of the total nitrogen produced by the sediments. (Author's abstract) W85-02070

MASS BALANCE MODELS OF PHOSPHORUS IN SEDIMENTS AND WATER, Canada Centre for Inland Waters, Burlington (On-

tario). For primary bibliographic entry see Field 2J. W85-02071

DYNAMIC PHOSPHATE BUDGET MODEL FOR A EUTROPHIC LAKE,

technische Hogeschool Twente, Enschede (Netherlands). L. Lijklema, and A. H. M. Hieltjes. Hydrobiologia, Vol. 91, p 227-233, July, 1982. 10 Fig. 5 Ref. Technische Hogeschool Twente, Enschede (Neth-

Descriptors: *Lake Brielle, *Netherlands, *Phosphate budget, *Eutrophic lakes, *Model studies, Simulation, Sediments, Primary production, Mineralization, Sedimentation, Adsorption, Cycling nutrients, Lakes.

The relations between the external nutrient loading of lakes, recycling through sediments and the resulting productivity are complicated by feed-back mechanisms, seasonal variations and trends. Simulation is a useful tool for the identification of controlling factors and the assessment of the effects of management measures, supplementary to experimental research. The model variables in our dynamic phosphate budget model include inorganic and organic particulate phosphate and dissolved o-phosphate, in both sediments and overlying water. Sediments may be aerobic or anaerobic, depending on topography, temperature and composition. The major processes described are primary production, mineralization, sedimentation, adsorption and diffusion. Several model parameters have been estimated directly for Lake Brielle (Netherlands). The sediment dilution rate, the extent of anaerobic conditions and the number and character of adsorption sites are important controlling factors. (Author's abstract)

SPATIAL HETEROGENEITY IN WHOLE LAKE SEDIMENTS - TOWARDS A LOADING ESTIMATE,

ESTIMATE, Alberta Environment, Edmonton. Water Resources Mangement Div.
T. B. Reynoldson, Jr., and H. R. Hamilton. Hydrobiologia, Vol. 91, p 235-240, July, 1982. 4 Fig, 4 Tab, 11 Ref.

Descriptors: *Lake Wabamum, *Alberta, *Lake sediments, *Nutrient loadings, Eutrophic lakes, Phosphorus, Isotope studies, Organic matter,

Studies of nutrient loadings, to shallow culturally cutrophied Alberta lakes, suggest internal inputs are significant. In this regard, estimation of bottom sediment P loads to Lake Wabamun (80 sq km, 5.5 m mean depth) were examined. Initially we determined the spatial variability in Total Organic Content (% loss on ignition) and Total Phosphorus, as indicators. Phosphorus (BAP) were measured at specific stations. These data showed a very uniform distribution in sediment type with a Total Organic Content of 40.6 +/- 3.3 (95% C.L.) at the west end, gradually declining to 26.3 +/- 0.9 at the east end. Transects performed at routine monitoring stations indicate the representativeness of each station, e.g., station 2, 40.8 +/- 1.3 (10 sites). One explanation of this uniformity is provided from Pb-210 analysis of shallow cores which indicate mixing to a depth of 16 cm. This is also thought to explain the mechanics of P loading to the water phase. Finally, Total Organic Content relates well to BAP (r(2) = 0.80). It is hoped that this simple technique may well permit more precise extrapolation to whole lake BAP estimates at least on this lake. (Author's abstract)

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW, New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section. J. P. Barlow, and M. S. Glase.

Descriptors: *Cayuga lake, *New York, *Salmon Creek, *Phosphorus, *Particulate matter, Mixing zone, Adsorption, Chemical precipitation, Sedimentation, Nutrients.

The mixing zone between Cayuga Lake, N.Y. and one of its tributaries, Salmon Creek, was studied to determine effects of physical processes such as adsorption, precipitation or sedimentation on phosdetermine effects of physical processes such as adsorption, precipitation or sedimentation on phosphorus discharge by the Creek. A high sodium concentration in the lake served as a natural tracer, by which proportions of Creek and Lake water were determined at any point in the mixing zone. Proportions of Creek and Lake water. were used to predict amounts of P that would be expected on the basis of mixing alone. Differences between predicted and observed concentrations were attributed to local physical processes. In several of the

six plumes surveyed, there was substantial loss of P due to sedimentation. The P-distribution in all plumes showed evidence of exchanges between particles and the medium, as a result of which soluble reactive-P usually decreased and soluble unreactive-P usually increased. The nature and magnitude of these local processes were such that they could have significant effects on the fate of stream-P discharged into the lake. (Author's abstract) W85-02075

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMOBILIZATION OF PHOSPHORUS IN OLIGOTROPHIC LAKE SEDIMENTS,

Rhode Island Univ., Kingston. Graduate School of Oceanography.

For primary bibliographic entry see Field 2J.

W85-02076

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS,

Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik. For primary bibliographic entry see Field 5B. W85-02077

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA,

Vienna Univ. (Austria). Limnologische Lehrkanzel A. Gunatilaka.

Hydrobiologia, Vol. 91, p 293-298, July, 1982. 3 Fig, 1 Tab, 26 Ref.

Descriptors: *Neusiedlersee, *Austria, *Seston, *Suspended sediments, *Shallow water, *Phos-phates, *Adsorption, Calcium, Langmuir isotherm, sotherms, Lake sediments, Nutrients, Illite, Chlo-

Previous evaluations of phosphorus adsorption ki-netics of lake sediments have used methods devel-oped for soil science; most of the extraction proceoped for soil science; most of the extraction procedures used in these investigations are from soil chemistry which involve the use of strong acids and alkalis that destroy some of the physical properties of natural samples. The phosphate adsorption capacity of suspended sediments from Neusiedlersee, (a 300 sq km, very shallow, highly turbid lake), was evaluated using a silicone oil-filter-centrifugation technique with P-32 and Tritium H2O labelling. This technique is quick, convenient and allows uptake processes to be followed during the first few seconds. The time dependent phosphate uptake was tested for concentration and pH dependency; the highest uptake was recorded at pH uptake was tested for concentration and pH de-pendency; the highest uptake was recorded at pH 9.00. The high calcite proportion in the sestonic material seems to influence the adsorption process; there is a high percentage of calcium bound phos-phate in the seston sample. The other clay minerals present in the sample, such as illite and chlorite, have a high affinity for phosphates only at an acid pH. The kinetics of adsorption (at lake orthophos-phate level and pH) could be explained by a bipha-sic Langmuir isotherm. The phosphate forms a monolayer when adsorbed on seston; adsorption taking place in various sites on the particle surface, monolayer when adsorbed on seston; adsorption taking place in various sites on the particle surface, or subsequent adsorption taking place in layers, may explain the two slopes in the isotherm. Adsorption may occur simultaneously on all sites, with higher energy sites being filled preferentially during the initial stages of adsorption. When the results are corrected for initial bound phosphate (assumed to be calcium bound phosphate 70.6%), the maximum phosphate adsorbed is equivalent to 588 micrograms/g seston (dry weight). (Collier-IVI) IVD W85-02079

DYNAMICS AND MECHANISMS OF ARSEN-ITE OXIDATION BY FRESHWATER LAKE

Saskatchewan Univ., Saskatoon. Dept. of Soil Sci-

Field 2-WATER CYCLE

Group 2H—Lakes

For primary bibliographic entry see Field 5B. W85-02080

MANGANESE CYCLE IN LAC LEMAN, SWITZERLAND: THE ROLE OF METALLOGEN-

Geneva Univ. (Switzerland). Inst. F.-A. Forel. J.-M. Jaquet, G. Nembrini, J. Garcia, and J. P.

Hydrobiologia, Vol. 91, p 323-340, July, 1982. 11 Fig. 4 Tab, 37 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Manganese, *Lac Leman, *Switzer-land, *Metallogenium, *Bacteria, Lake sediments, Sediments, Interstitial water, Suspended solids, Scanning electron microscopy, Transmission elec-tron microscopy, Sediment-water interface, Cy-cling nutrients, Zinc, Cadmium, Iron.

The manganese pathways in Lac Leman have been investigated on the basis of chemical analyses undertaken on water, suspended solids, bottom sediments and interstitial water samples. The various modes of occurrence of Mn have been determined by means of visual examination using SFM and modes of occurrence of Mn have been determined by means of visual examination using SEM and TEM (scanning and transmission electron microscopy), by microanalysis (EDAX) of various sediment fractions, by chemical analysis of the dissolved phase, and by chemical speciation and XRD of bottom sediments. Fluxes to and from the sediment have also been computed. The time-depth variations of Mn in the water column are characterized by (a) a very steep gradient of Mn sol. from the sediment interstitial water (15 mg/L) to the overlying water, 2 m above the bottom (500 micro g/L), (b) an accumulation of Mn part. between 280 m and the interface at 310 m, consisting of mineralized colonies of Metallogenium. The abundance of Metallogenium colonies is inversely related to O2 concentration; the optimal value for the bacterium Metallogenium colonies is inversely related to O2 concentration; the optimal value for the bacterium Mn fixation is around 1 mg/L. Because of the quasi-anoxic state of the bottom sediments and overlying water, Mn diffuses from a 'source layer', 2-5 cm below the interface (a) upwards across the interface, before being taken up by Metallogenium, and (b) downwards to a 'sink layer', in which large amounts of Mn-carbonate precipitate. Particulate Mn sedimentation cates measured in trans about amounts of Mn-carbonate precipitate. Particulate Mn sedimentation rates measured in traps show that downwards Mn flux due to Metallogenium settling approximately balances the upwards soluble flux due to diffusion. Quantitatively, the process of Mn cycling in Lac Leman is, therefore, limited to the lowermost part of the hypolimnion. Although Zn and Cd seem to follow the same cycle as Mn, Fe behaves in a different manner; it was not taken up by Metallogenium at the time of our study. (Author's abstract)

PARTICLE SIZE DISTRIBUTION AND CHEM-ICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT, Orange Free State Univ., Bloemfontein (South Africa). Dept. of Botany. P. C. Keulder.

Hydrobiologia, Vol. 91, p 341-353, July, 1982. 15

Descriptors: *Wuras Dam, *South Africa, *Particle size, *Chemical properties, *Sediments, Sodium, Potassium, Calcium, Magnesium, Phosphorus, Phosphates, Passega classification.

As part of an ecosystem study of Wuras Dam, a small mesotrophic turbid impoundment in the semi-arid part of South Africa, an investigation was made of the particle size distribution, organic content and inorganic chemical composition of the sediment. Nine transects 50 m apart were made during February 1980. Sediments were sampled with an Eckman grab. The following analyses were made: size fractionation by wet sieving, cation exchange capacity, exchangeable Na, K, Ca, Mg and PO4, total P, and loss on ignition. From the results it was clear that the finer particles, in or near the original river bed, had higher cation exchange capacity, total P, exchangeable phosphorus and organic content. Littoral areas with avian habitat and extensive macrophyte vegetation, contained coarser sediments. Organic detritus appar-

ently migrated to the deeper part of the impound-ment. Sediments of lacustrine and fluvial origin were identified by means of the Passega classifica-tion. (Author's abstract) W85-42082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND, Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry.

G. Nembrini, J. A. Capobianco, J. Garcia, and J.-M. Jacquet.
Hydrobiologia, Vol. 92, p 363-375, July, 1982. 7 Fig. 2 Tab, 35 Ref. Swiss National Research Foundation projects 2.606-0.76 and 2.314-0.79.

Descriptors: *Lac Leman, *Switzerland, *Intersti-tial water, *Iron, Vivianite, Siderite, Sulfides, Iron sulfides, Manganese, Trace metals, Lake sediments,

The pore fluids of the sediments collected at the The pore fluids of the sediments collected at the deepest point of Lac Leman (Switzerland) are supersaturated with respect to vivianite and siderite. In the presence of sulfide, the iron solubility is controlled entirely by the amorphous iron sulfides. As the iron (II) becomes dominant, the formation of siderite occurs and evidence of this, in the solid of sucertic occurs and evidence of tims, in the solid phase, can be obtained by the use of Mossbauer spectroscopy and some sequential chemical extrac-tions. The amount of 'sideritei ron' decreases from about 10% near the sediment surface to a few percent in the lower levels of the sediment (< 10 cm). Evidence for vivianite formation could not be cm). Evidence for vivianite formation could not be obtained even in the lower layers, despite the precautions taken to avoid oxidation. Although the trace metal behavior in the solid phase is well correlated with the iron and manganese, availability in the pore fluid is dependent on the adsorption on, or co-precipitation with, finely dispersed colloids, which pass through a 0.45 micro m filter. Trace metal concentrations in pore fluid were directly related to total elemental concentrations in the solid phase, and did not reflect cumulative. the solid phase, and did not reflect cumulative trends associated with anthropogenic enrichment. (Author's abstract) W85-02084

RATES OF SEDIMENT-WATER EXCHANGE OF OXYGEN AND SEDIMENT BIOTURBA-TION IN LOUGH NEAGH, NORTHERN IRE-

ALUND, New Univ. of Ulster, Coleraine (Northern Ireland), Limnology Lab.

B. Rippey, and D. H. Jewson.
Hydrobiologia, Vol. 92, p 377-382, July, 1982. 4

Descriptors: *Lough Neagh, *Northern Ireland, *Bioturbation, *Sediment-water interface, *Oxygen, *Lake sediments, Eutrophic lakes, Benthos, Chlorophyll a, Redox potential, Interstitial water, Advection.

Oxygen is transported 30 mm into the sedim an 8 m depth site in eutrophic Lough Neagh by the irrigational activities of the benthic fauna. Faunal an 8 m depth site in eutrophic Lough Neagh by the irrigational activities of the benthic fauna. Faunal activity also mixes the upper 20 mm of sediment. Sediment oxygen uptake rate, redox potential-depth profile and the chlorophyll a concentration were measured in the upper sediment layers from February to November 1979. Chlorophyll a input to the sediment, following the Spring phytoplank-ton maximum, remained in the 0-1 cm sediment layer but did cause the redox potential profile to change from one with potentials around 400 mV in the upper 50 mm to one with a strong gradient over the 0-30 mm region. The start of benthic faunal activity in May caused the chlorophyll a to be mixed into the 1-2 cm layer and also caused oxygen to be transported into the sediment at a rate sufficient to change the redox potential back to its initial state. The biodiffusion coefficient for solids in the upper 20 mm was estimated to be (6 x 10 to the minus 8th power) sq cm/s. Oxygen transport in the pore waters of the upper sediment layers was considered to be best described as advection, caused by the irrigational activities of the benthic fauna. (Author's abstract)

VERTICAL STRATIFICATION IN SEDIMENTS FROM A YOUNG OLIGOTROPHIC SOUTH AFRICAN IMPOUNDMENT: IMPLICATIONS IN PHOSPHORUS CYCLING,

Natal Univ., Pietermaritzburg (South Africa). Dept. of Botany. A. J. Twinch, and C. M. Breen.

Hydrobiologia, Vol. 92, p 395-404, July, 1982. 6 Fig, 2 Tab, 42 Ref.

Descriptors: *Midmar Dam, *South Africa, *Phosphorus, *Oligotrophic lakes, *Sediments, Organic carbon, Hydrogen ion concentration, Aluminum, Adsorption, Phosphates, Sediment-water interface, Langmuir isotherms, Adsorption isotherms, Isotopic tracest. Lakes tonic tracers. Lakes.

Changes at the mud surface in Midmar Dam, following impoundment, were studied by examining vertical profiles of selected parameters in sediment cores. Distinct stratification in organic carbon, pH and exchangeable Al(3+) was evident. Phosphate adsorption characteristics in the stratified sediments was quantified using Langmuir adsorption isotherms. The adsorption maxima and bonding energy constants in the surface sediments (0-3 cm) were markedly lower than those below 3 cm, indicating that the surface layers are less efficient at binding phosphate than the deeper layers. Radiotracer experiments indicate that the layers comprising the top 3 cm of sediment predominate in PO4-P exchange with the overlying water. (Author's abstract)

FLUX OF REDUCED CHEMICAL CONSTITU-ENTS (FE(2+), MN(2+), NH4(+) AND CH4) AND SEDIMENT OXYGEN DEMAND IN LAKE ERIE,

Wright State Univ., Dayton, OH. Dept. of Chem-

D. D. Adams, G. Matisoff, and W. J. Snodgrass. Hydrobiologia, Vol. 92, p 405-414, July, 1982. 3 Fig. 4 Tab, 35 Ref. EPA contracts R 8057160 and R806756011, OWRT project A-059.

Descriptors: *Lake Erie, *Ammonium, *Methane, *Ferrous iron, *Manganese, *Iron, *Sediment oxygen demand, *Chemical reduction, Oxygen demand, Lake sediments, Dissolved oxygen, Sediment-water interface, Interstitial water, Lakes.

Sediment pore water concentrations of Fe(2+), Mn(2+), NH4(+) and CH4 were analyzed from both diver-collected cores and an in situ equilibration device (peeper) in Lake Erie's central basin. tion device (peeper) in Lake Erie's central basin. Sediment oxygen demand (SOD) was measured at the same station with a hemispheric chamber (including DO probe and recorder) subtending a known area of sediments. The average SOD was 9.4 mM/sq m/day (0.3 g/sq m/day). From pore water gradients within the near-surface zone, the chemical flux across the interface was calculated indirectly using Fick's first law modified for sediments. These calculations, using core and peeper gradients, always showed sediment loss to overlying waters, and variations between the two techniques differed by less than an order of magnitude for Fe(2+) and CH4. The transport of these reduced constituents can represent a sizeable oxygen demand, ranging from less than 1% for Fe(2+) and Mn(2+) to as high as 26% for NH4(+), and 30% for CH4. The average flux of these constituents could account for about a third of the SOD at the sediment-water interface of this station. (Author's abstract)

AVAILABLE PHOSPHORUS IN LAKE SEDI-MENTS IN THE NETHERLANDS,

Northwestern Connecticut Regional Planning Commission, Warren, CT. Lake Waramaug Task

S. P. Klapwijk, J. M. W. Kroon, and M. L. Meijer. Hydrobiologia, Vol. 92, p 491-500, July, 1982. 3 Fig. 4 Tab. 21 Ref.

Descriptors: *Netherlands, *Phosphorus, *Lake sediments, *Algae, *Bioassays, Sediments, Phosphorus

Lakes-Group 2H

phates, Nutrient uptake, Iron, Clays, Organic matter, Lakes.

The amount of phosphorus available to algae in the sediments of four lakes in the western part of the Netherlands has been assessed by means of chemical extractions and bioassay techniques. In addition to direct chemical sediment analyses, extractions were carried out with an NTA column method and a stepwise NH4 Cl-NaOH-HCl shaking method, the latter supposedly separating the weakly bound, the Fe- and Al-bound and the Cabound phosphates in the sediments. Bioassays, with sediment as the sole source of P, were made with Scenedesmus quadricauda in modified Skulberg's Z8 medium to determine the amount of phosphates available to algae. The average total P concentration of the sediments varid from 0.8 to 3.6 mg P/g dry wt and correlated well with the net external P loading of the lakes. Uptake of P by algae in the bioassays varied from 0.4 to 36% while NTA extracted 36-69% of the total P. The ratio NH4Cl extracted/NaOH extracted/HCl extracted phosphates is different from lake to lake, although in all lakes the highest extractions (27-62% of total P) are found in the NaOH fraction. However, in the party sediments of these lakes, the NaOH step extracted not only the Fe- and Al-bound phosphates but also, large amounts of humus compounds. Hence, this fraction also contains non-available organic P. The results are related to soil type and chemical characteristics of the sediments, and compared with data from other authors. A positive correlation was found between phosphate available to algae and NTA- and NaOH-extractable P, but the correlation with total phosphorus was higher. Algae-extractable P proved to be positively correlated with total iron and clay content and negatively with the amount of organic matter. The sediments in the investigated lakes show great carriability and the chemical extraction techniques cannot replace the bioassays to assess the amount of phosphorus available to algae. (Author's abstracti)

EPILIMNETIC NUTRIENT LOADING BY ME-TALIMNETIC EROSION AND RESULTANT ALGAL RESPONSES IN LAKE WARAMAUG, CONNECTICUT, Hoogheemraadschap van Rijnland, Leiden (Neth-

Hoogheemraadschap van Rijnland, Leiden (Netherlands).

R. W. Kortmann, D. D. Henry, A. Kuether, and S.

Kaufman. Hydrobiologia, Vol. 92, p 501-510, July, 1982. 8 Fig, 1 Tab, 13 Ref.

Descriptors: *Lake Waramaug, *Connecticut, *Epilimnion, *Nutrient loading, *Metalimnion, Algal growth, Cycling nutrients, Stratification, Phosphorus, Lake sediments, Secchi depth, Dissolved oxygen, Water temperature, Diffusion, Thermal stratification, Lakes.

Phosphorus regeneration from lake sediments, and subsequent migration to trophogenic surface water, significantly contributes to the lake nutrient budgets and algal bloom conditions in some lake types. Decomposition of organic matter in deep water and sediments results in the accumulation of regenerated nutrients, alternate electron acceptors (reduced products of anaerobic respirations = COD), carbon dioxide, and depletion of dissolved oxygen (electron acceptor in aerobic respiration). Thermal stratification creates spatial segregation of trophogenic and tropholytic environments in the lake, resulting in gradients between sediments, hypolimnion, and the epilimnion. Exchange of oxygen, nutrients, and reduced alternate electron acceptors between the hypolimnion and epilimnion affects the productivity of a lake. Secchi depth, temperature, and dissolved oxygen profiles were determined twice each week from May 1980 to October 1980 at each of five lake stations. Nutrient concentration profiles, including total soluble and total hosphorus, ammonium-N, nitrate, soluble Kjeldahl, and total Kjeldahl nitrogen were determined twice each month. Epilinmetic algal samples were collected twice each week using Kemmerer and water column 'straw' samplers. Cell counts of total, green, bluegreen, and diatom algae groups were made. Three methods were used to describe

hypolimnetic-epilimnetic exchange, including coefficients of eddy diffusion (based on lake heat budget), a graphical method of defining thermocline location, and relative thermal resistance to mixing (RTRM, based on density differences). All three methods yielded comparable estimates of net seasonal transport. The graphical and RTRM methods described events occurring at shorter intervals (greater resolution). We find general agreement between the three methods of describing hypolimnetic-epilmnetic transport. The frequency of sampling resulted in increased resolution of thermal profiles (in time), allowing accurate estimation of short-term nutrient flux into epilimnetic waters. An algal bloom event occurred 5 to 12 days following erosion of the top of the metaliamnion to below the aerobic-anaerobic interface. The lag time to peak algal concentration, following such events, decreased through the summer (June = 12 days, September = 5 days). (Author's abstract) W85-02093

MECHANISMS FOR RELEASE OF SEDI-MENT-BOUND PHOSPHATE TO WATER AND THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOS-PHATE,

Ohio State Univ., Columbus. Dept. of Agronomy. For primary bibliographic entry see Field 5B. W85-02095

ACIDIFIED LAKES: SEDIMENT TREATMENT WITH SODIUM CARBONATE - A REMEDY, Lund Univ. (Sweden). Limnological Inst. For primary bibliographic entry see Field 5G. W35-02096

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING, National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab. For primary bibliographic entry see Field 5G. W85-02097

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER, Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5B. W85-02098

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES,

Florida State Museum, Gainesville. M. S. Flannery, R. D. Snodgrass, and T. J. Whitmore.

Whitmore. Hydrobiologia, Vol. 92, p 597-602, Jul, 1982. 4 Fig, 2 Tab, 12 Ref. NSF grant DAR 79-2418.

Descriptors: *Lake sediments, *Trophic level, *Eutrophication, *Florida, Lakes, Sediments, Aluminum, Iron, Calcium, Nitrogen, Phosphorus, Chlorophyll.

Sediment cores were taken from near maximum depth in 15 Florida lakes representing a wide range of trophic conditions. Chemical analyses of surface sediments showed Al, Fe, and Ca to be the most abundant elements in all samples, and the ratio of Al to Ca to be smaller for eutrophic lakes. Sediment organic matter increased with trophic state, as did the degree to which it was enriched in nitrogen. Corresponding sediment C/N ratios decreased with increasing lake trophic state and showed significant negative correlation with chlorophyll a, total N, and total P in the water column. The abrupt changes in the C/N ratios of the lake sediments may be indicative of dramatic changes in both trophic conditions and sedimentation rates. Before C/N ratios can be used along with sedimentary chlorophyll derivatives to indicate past trophic state, the sediment profiles must be reliably dated and compared to other fossil indicators of trophic condition. (Baker-IVI)

SEDIMENTATION RATES IN A SWISS-IT LAIN LAKE MEASURED WITH SEDIMENT TRAPS,

Commission of the European Communities, Ispra (Italy). Joint Research Centre. For primary bibliographic entry see Field 2J. W85-02100

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEM-ISTRY OF LAKES BOURGET, ANNECY AND LEMAN,

Geneva Univ. (Switzerland). Inst. F.-A. Forel. J. P. Vernet, and P.-Y. Favarger. Hydrobiologia, Vol. 92, p 643-650, July, 1982. 4 Fig, 1 Tab, 5 Ref.

Descriptors: *Sedimentation, *Geochemistry, *Climate, *Environmental effects, *Lake Bourget, *Lake Annecy, *Lake Leman, *France, *Switzerland, Palynology, Carbonates, Organic carbon, Heavy metals, Eutrophication, Lakes.

During the last glaciation, the Rhone glacier extended as far as the region of Lyon and covered Lakes Bourget, Annecy and Leman. Glacial retreat successively freed Lakes Bourget and Annecy, it reached Geneva around 14 000 B.P. and the head of Lake Leman at about 12 000 B.P. Deposits situated between Nyon and the foot of the Jura provide a complete palynological zonation and serve as a type section for the lake core studies. A palynological horizon (about 1 800 A.D.) has been found in Lake Bourget and wood has been dated at 3 230 +/- 65 B.P. (C-14) in a core from Lake Leman. Three 6 m cores from each lake were sampled together with many 0.5 m cores from Leman. The short Lake Leman cores have been dated by Cs-137 and provide a precise indication of changes in the basin during recent decades. Holocene climatic variations are evident in the Leman cores and are reflected by concentrations of carbonate and organic carbon which increases at the end of the Allerod and reach a maximum in the Atlantic Period (climatic optimum). Human settlement began at the beginning of the Christian era. All the cores show increases in the organic matter and nutrients; from the turn of the century in the Leman, and later for the other lakes where eutrophication started only a few decades ago, NAI-P shows a very recent increase, around 1965 in the Leman. Heavy metals (Hg, Cd and Pb) show increases at about 30 years ago in Annecy, at about the turn of the century in Lake Leman and in the mid-19th century in Lake Bourget. (Author's abstract)

SEASONAL STUDY OF METHANE OXIDATION IN LAKE WASHINGTON, Washington Univ., Seattle. Dept. of Microbiology. M. E. Lidstrom, and L. Somers. Applied and Environmental Microbiology, Vol. 27, No. 6, p 1255-1260, June, 1984. 4 Fig. 3 Tab, 12 Ref. USDA grant 5901-0410-8-0154-0.

Descriptors: *Methane, *Oxidation, *Lake Washington, *Washington, Seasonal variation, Methane bacteria, Sediment-water interfaces, Sediments.

The distribution of methane and methane-oxidizing bacteria in the water column of Lake Washington was determined monthly for 1 year. The methane profiles were relatively constant, with little stratification and low concentrations (0.05 to 0.5 micro M). The number of methane-oxidizing bacteria detected by a filter-plating method was routinely < 1/ml throughout the water column, and no incorporation or oxidation of methane was detected by radioisotopic labeling, even after methane was added. However, samples taken from the sedimentavet interface contained as much as 3 micro M methane and 50 CFU of methane-oxidizing bacteria per ml and showed significant rates of methane oxidation and incorporation. To define the region of maximum activity more precisely, vertical profiles of the sediment were examined. The concentration of methane increased with depth to a maximum of 150 to 325 micro M at 2.5 cm, and significant rates of methane oxidation were found within

Field 2—WATER CYCLE

Group 2H-Lakes

the top 2.5 cm. The apparent Kms for methane and oxygen were determined for samples from the top 1.0 cm of the sediment and found to be ca. 10 and 20 micro M, respectively. Projected values for methane oxidation rates suggested that maximum methane oxidation occurred in the top 0.5 cm of the sediment. (Author's abstract) W85.02134

DEPENDENCE OF HYPOLIMNETIC OXYGEN CONSUMPTION ON AMBIENT OXYGEN CONCENTRATION: FACT OR ARTIFACT. McGill Univ., Montreal (Quebec). Dept. of Biol-

R. J. Cornett, and F. H. Rigler. Water Resources Research, Vol. 20, No. 7, p 823-830, July, 1984. 7 Fig. 4 Tab, 35 Ref.

Descriptors: *Dissolved oxygen, *Hypolimaion, *Oxygen depletion, Aerobic respiration, Lake sedi-ments, Chemical reactions, Seasonal variation.

Ten lakes studied in this investigation and the data presented by previous authors are all consistent with the hypothesis that rates of oxygen depletion in the hypothesis that rates of oxygen depletion in the hypothesis that rates of oxygen depletion the ambient oxygen concentration over the range the ambient oxygen concentration over the range of concentrations from 12 mg/L to 1.0 mg/L. By definition, aerobic respiration must stop when there is no more oxygen present. Therefore the hypolimnetic oxygen deficit can be modeled as a zero-order chemical process that is independent of oxygen concentration. Predictions of seasonal changes in hypolimnetic oxygen concentrations can be made by estimating the slope of the linear regression of oxygen concentration against the Julian day when the sample was collected. (Author's abstract) thor's abstract) W85-02149

2I. Water In Plants

STOMATAL CONTROL OF WATER USE EFFI-CIENCY IN POPLAR CLONES AND HYBRIDS, Toronto Univ. (Ontario). Faculty of Forestry. T. J. Blake, T. J. Tschaplinski, and A. Eastham. Canadian Journal of Botany, Vol. 62, No. 7, p 1344-1351, July, 1984. 16 Fig, 2 Tab, 19 Ref.

Descriptors: *Water use efficiency, *Stomatal transpiration, *Poplar, Transpiration, Trees, Productivity, Leaves, Plant tissue.

Water use efficiency (WUE, the ratio of dry matter water use enticement (WOE), the ratio of try matter produced to water used in transpiration) was stud-ied in 17 poplar clones and hybrids. Although WUE could not be predicted from the poplar group alone, water efficiency was found to vary in different poplar genotypes. For example, a balsam poplar, Populus maximowiczii M-4 (section Tacadifferent poplar genotypes. For example, a balsam poplar, Populus maximowiczii M-4 (section Tacsmahaca), and a white poplar clone, P. alba A-499 (section Leuce), had twice the dry matter production per unit of water transpired compared with another clone of P. maximowiczii (M-13) and a cottonwood clone, P. nigra N-80 (section Aegeiros), which showed low WUE. The reduced transpiration in water-efficient clones per unit of dry matter produced was associated with a higher stomatal resistance on the abaxial leaf surface. However, the physiological and morphological stomatal resistance on the abaxial leaf surface. However, the physiological and morphological basis of WUE varied in different clones. Water-efficient clones exhibited one or more of the following adaptations restricting water loss: (i) conspicuous cuticular ledges or hairs above the pore openings of stomata, (ii) earlier partial stomatal opening in the morning, and (iii) smaller stomata and a lower stomatal frequency on the adaxial surface of the upper leaves. Poplar clones of low WUE exhibited less stomatal control of transpiration as a result of lower stomatal resistances and they lacked the above adaptations. Relative ranking of genotypes could not be predicted from either dry matter productivity or transpiration rate alone although the most water efficient clones energher with less efficient clones. (Author's abstract) W85-01646

PHENOLOGY AND WATER RELATIONS OF THREE PLANT LIFE FORMS IN A DRY TREE-LINE MEADOW, Washington Univ., Seattle. Dept. of Botany. L. E. Jackson, and L. C. Bliss. Ecology, Vol. 65, No. 4, p 1302-1314, August, 1984. 6 Fig. 2 Tab, 42 Ref. NSF grants DEB 79-13421 and DEB 78-23260.

Descriptors: *Drought, *Phenology, *Plant physiology, *Meadows, Soil water, Polygonum, Penstemon, Saxifraga, Dormancy, Stomatal transpiration, Conductance, Plant growth, Reproduction, Leaf water potential, Snowmelt.

The relationship between physiological and phenological adaptions to drought was examined in three species of different life form in a tree-line meadow in the Sierra Nevada. Soil moisture in this meadow is predictably high following snow melt, but decreases through the summer because of infrequent precipitation. There were large differences among the life forms in allocation patterns and in vegetaive and reproductive phenologies, but there were no comparable differences in their water relations. The annual Polygonum minimum and the hemicryptophyte Penstemon heterodoxus respond to decreasing soil moisture by reducing conductance; they consequently maintain a longer activity decreasing soil moisture by reducing conductance; they consequently maintain a longer activity period. The geophyte Saxifraga aprica has little stomatal control of water loss and becomes dormant as soils dry. Penstemon heterodoxus is a long-lived perennial with an intermediate rootshoot ratio (1.9), evergreen leaves, and a high allocationn to vegetative structures. Leaf growth occurs during the first part of the season, while the soil is moist. Flowering begins at the end of shoot growth, and fruits dehisce 3 mo after snow melt. During a dry summer, plants were observed to lose many leaves; 25% of the plants died, and none of the remaining plants flowered the next year. Almany leaves; 25% of the plants ciect, and none of the remaining plants flowered the next year. Although Penstemon decreases conductances under a limited range of leaf water potential, it is still not well adapted to long dry periods. Polygonum minimum is a very small annual with a low rootshoot ratio (0.15) and an indeterminate growth pattern. mum is a very small annual with a low rootsshoot ratio (0.15) and an indeterminate growth pattern. After a period of solely vegetative growth, leaves and floral structures produced continually until psi soil reaches - 5 MPa. Seeds dehisce about 2 mo after anow melt. Total seed production is a function of the length of the growth period. Regulation of water balance by stomatal control assures adequate time for fruit production. Other annuals in the community had a very similar phenological pattern. Saxifraga aprica has a high rootshoot ratio (5.0) and a small basal rosette of leaves. Leaf growth occurs for only 2 wk and is followed immediately by flowering. Only 5-10% of the plants flower each year. Fruits mature 5 wk after snow melt, and plants become dormant at - 0.5 MPa or within 6 wk of snow melt. This species and the other ephemeral geophytes complete their growth during the period of predictable high soil moisture, and therefore require little ability to regulate water balance. This study provides evidence that high diversity in life forms is maintained in environments with high yearly variability in the lengths of the drought and snow-free periods. No single set of phenological and physiological characteristics is optimally adapted to the variability in the subalpine environment that was studied, and therefore several adaptive strategies co-occur. (Authe subalpine environment that was studied, and therefore several adaptive strategies co-occur. (Author's abstract) W85-01892

WATERLOGGING TOLERANCE OF LOW-LAND TREE SPECIES OF THE SOUTH, Clemson Univ., SC. Dept. of Forestry.

Southern Journal of Applied Forestry, Vol. 8, No. 3, p 136-149, August, 1984. 2 Fig. 2 Tab, 79 Ref.

Descriptors: *Trees, *Flooding, *Waterlogging tolerance, Seedlings, Soil saturation, Soil-water plant relationships.

Waterlogging tolerance refers to a species' ability, from seedling stage to maturity, to tolerate soil asturation or inundation during the growing season. Many tree species in the South are adapted to periodic and/or prolonged soil waterlogging-reviously published waterlogging-tolerance rat-

ings, a frequency-occurrence scheme, and a new relative waterlogging-tolerance rating are present-ed in a table for southern lowland tree species. The ed in a table for southern lowland tree species. The relative waterlogging tolerance ratings can be used to predict in general what may happen to the population of a species in question under specific conditions. In doing so, one must take into account the prior waterlogging history of the population, age, general vigor of the trees, type, duration, frequency, and timing of waterlogging. (Moore-IVI) W85-02111

AGRICULTURAL DROUGHTS AT PEDDA-PURAM, EAST GODAVARI DISTRICT, ANDHRA PRADESH,

Andhra Univ., Waltair (India). Dept. of Meteorol-

Andria Only, Walani ogy and Oceanography. A. R. Subramaniam, and A. V. Rao. Mausam, Vol. 34, No. 4, p 439-442, 1983. 2 Fig, 1

Descriptors: *Drought, *Millet, *Crop yield, *Peddapuram, *India, Soil water, Forecasting, Water balance, Plant growth, Rainfall, Ragi.

Agricultural drought was studied in relation to Agricultural drought was studied in relation to ragi (finger millet) grown under rainfed conditions at Peddapuram, India. Weekly meteorological data and yield data were analyzed for the period 1960 to 1976. The regression relationship between the yields of ragi and seasonal index of moisture adequacy was developed for forecasting of crop yield. The index of moisture adequacy and soil moisture as a percentage of available moisture capacity are computed during phenological stages of crop growth for the years of highest, normal and lowest yields. For these years weekly water balance patterns are also presented. For the highest yield year (1964), soil moisture never fell below 50% during the growth period. It never fell below 40% in any the growth period. It never fell below 40% in any week of the growing season in 1960 when average yield was reported. Soil moisture only reached 50% once during the crop growth period in the year (1965) when the crop failed completely. (Moore-IVI) W85-02126

WATER BALANCE AND CROPS IN KARNA-

TAKA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
A. R. Subramaniam, and A. V. R. Kessavo Rao.
Mausam, Vol. 35, No. 1, p 55-60, 1984. 9 Fig, 1
Tab, 8 Ref.

Descriptors: *Hydrologic budget, *Plant water po-tential, *India, *Climatic data, *Crop production, Rice, Kharif jowar, Rainfall, Evaporation rate, Evapotranspiration, Water deficit, Moisture avail-

Karnataka, the sixth largest state in India, has a range of moist climates that allows a wide variety of crops. Climatic water balance data and indices een calculated for all the available meteorological stations in the State and they are carto-graphically analyzed. The general distribution of crops and the results of the analysis of moisture adequacy are compared to identify the limits of moisture adequacy for certain important crops like moisture aucquacy for certain inflorance to the incirce, jowar, baijra, ragi, sugarcane, groundnut, cotton and coffee. In Kharif season, high production yields of jowar are generally being recording in areas of 70% moisture adequacy. (Wheatley-W85-02127

WATER HYACINTH CANOPY AND PAN EVAPORATION, Meteorological Office, Poona (India)

For primary bibliographic entry see Field 4A. W85-02128

Erosion and Sedimentation—Group 2J

2J. Erosion and Sedimentation

ELEMENTAL COMPOSITION OF SUSPEND-ED PARTICLES FROM THE YELLOW AND YANGTZE RIVERS,

Lamont-Doherty Geological Observatory, Pali-

Y.-H. Li, H. Teraoka, T.-S. Yang, and J.-S. Cher Geochimica et Cosmochimica Acta, Vol. 48, No. 7, p 1561-1564, July, 1984. 2 Fig, 1 Tab, 14 Ref. DOE grant EW 76-S-02-2185.

Descriptors: *Chemical composition, *Suspended sediments, *Yellow River, *Yangtze River, *China, *Kansu Province, Loess, Erosion, Soil chemistry, Trace metals, Calcium carbonate, Strontium, Zinc, Copper, Nickle, Cobalt, Lead, Water sellution provession.

Most of the suspended particles downstream of the Yellow River are supplied by intensive erosion of the loess terraces of China. The elemental composition of Yellow River suspended particles sampled in 1980 and 1981 closely resembles that of a Malang loess obtained from the Kansu Province (5.5 m below soil surface). The high concentration of Ca and Sr in both samples represents the occurrence of CaCO3 minerals. The concentration of Zan, Cu, Ni, Co and Pb in the suspended particles are higher in the Yangtze River than in the Yellow River; concentrations of these same elements in the Yellow River suspended particles are much closer to those of the world's average soils than those of the world's average soils than those of the world's average river suspended particles indicating that the pollution input of these trace metals in the Yellow River is minor as compared with the natural inputs. (Collier-IVI)

FORESTS, FLOODS, AND EROSION: A WATERSHED EXPERIMENT IN THE SOUTH-EASTERN PIEDMONT,

Georgia Univ., Athens. School of Forest Re-

J. D. Hewlett, and R. Doss.

Forest Science, Vol. 30, No. 2, p 424-434, June, 1984. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Erosion, *Forest management, *Flooding, *Georgia, *Forest watersheds, Forest-ry, Floods, Erosion, Storm runoff, Clearcutting, Cutting management, Road construction.

A paired watershed experiment to determine the effect of clearcutting and regeneration of pine on the Georgia Piedmont showed that the small stormflows on dry soil may be increased 50 percent or more, but that larger flood discharges from wet soil were increased only 10 to 15 percent, if at all. The annual flood is apt to be of the latter type. The reasoned conclusion is that concern about the effects of forest operations on downstream flooding of creeks and rivers is unwarranted. However, peak rates of discharge immediately below the operation increased 30-45 percent, resulting in a 55-percent annual increase in stormflow erosivity during the 4-year cycle of harvesting, site preparation, and machine planting. The increase in erosivity of stormflows following this typical southern forestry operation, when considered in light of the accompanying increase in erosion hazard due to accompanying increase in erosion hazard due to soil disturbance, warns the forest manager to increase his vigilance over road design, the selection of regeneration methods, and the maintenance of streamside protection zones. (Author's abstract)

DESIGN OF ARMOUR SYSTEMS FOR THE PROTECTION OF RUBBLE MOUND BREAKWATERS,

WALERS, Baird (W.F.) and Associates, Ottawa (Ontario). W.F. Baird, and K. R. Hall. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 164-176, June, 1984. 10 Fig. 41 Ref.

Descriptors: *Wave action, *Breakwaters, *Design criteria, *Armor layers, Model studies, Concrete costruction, Erosion control, Beach erosion.

Wave protection systems, or armor layers, evolved as breakwaters consisting of dumped stones or quarry run built in deeper water and at locations as breakwaters consisting of dumped stones or quarry run built in deeper water and at locations exposed to increasingly severe environmental load-ings. There are two basic design methods, one involving the use of hydraulic model studies, the other involving the use of empirical equations that relate wave height to the weight of the armor unit. Both procedures have many limitations. Use of these design procedures in recent years have led to damage of many breakwaters. Well designed and carefully executed model studies are an essential part of the design of a large rubble mound struc-ture located in deep water. Many of the rubble mound breakwaters existing today that have not been damaged contain an armor layer designed to be stable without the assistance of interlocking between units. The full potential of armor stones in protecting a breakwater has not been realized. Armor layers consisting of quarried stones could be used at many locations where more expensive and problematic concrete units have been used in the past, if innovative designs are used in place of traditional concepts. (Collier-IVI) W85-01707

MORPHOLOGY AND RECENT SEDIMENTS OF THE LOWER ANASTOMOSING REACHES OF THE ATTAWAPISKAT RIVER, JAMES BAY, ONTARIO, CANADA, Guelph Univ. (Ontario). Dept. of Land Resource

N. A. King, and I. P. Martini. Sedimentary Geology, Vol. 37, No. 4, p 295-320, February, 1983/1984. 16 Fig, 2 Tab, 31 Ref.

Descriptors: *Attawapiskat River, *Ontario, *Sediments, *River morphology, *Channel morphology, Nival regime, Sediment transport, Floods, Anastamosis, Ice rafting, Ice jams, Sedimentation, Sedimentatio

The Attawapiskat River is one of the major low-gradient rivers which cross the flat wetlands of the Hudson Bay Lowland. It has a nival regime lead-Hudson Bay Lowland. It has a nival regime leading to strong, short-duration spring floods during which considerable amount of sediment is carried. For the remainder of the year only organic matter is transported in solution and suspension. The land is isostatically rebounding after the Pleistocene glaciations. The river downcuts through the softer Holocene estuarine basal clays and the Pleistocene tills, to the Paleozoic carbonate bedrock. The river develops an anastomosing pattern in the lower reaches and it acquires an irregular meandering character inland. It does not construct a significantly thick delta as the river-borne sediments are dispersed along the coasts by tides, longshore currents and ice rafting. The river is subjected to frequent ice jams its lower reaches as warmer southern waters flow toward the still frozen mouth and sea. During the jams, secondary channels southern waters now toward the staff trożen mouth and sea. During the jams, secondary channels become active, flooding develop and sedimentation occurs on the levees. Ice scours and ice-rafted materials affect the river banks greatly. The principal sedimentary environments within the river consist of: (1) erosional shoals covered by boulder and pai seamentary environments within the river consist of: (1) erosional shoals covered by boulder and pebble lags over till; (2) sorted coarse to medium-sized sands in junction bars downstream from islands; these sands frequently develop gas bubbles, and they contain characteristic fining-upward sequences from boulder pavements at the base, grading up into rippled sand with abundant organic matter, grading up into laminated silt and sand and organic matter, grading up into laminated silt and sand and organic matter, go secondary channels, which develop thin silty and clay drapes on eroded hard substratum and are filled eventually by thick peats; and (4) river banks which show well-developed regressive sequences from Pleitocene tills at the base, overlain by estuarine sparsely fossiliferous clays, capped by thin conglomeratic units with abundant reworked Macoma balthica shells, grading upward into upper tidal flat sand, irregularly laminated sand and silt of marshes, and result interbedding of sand, silt and organic layers of the levees at the top. (Author's abstract)

SANTA ANA RIVER: AN EXAMPLE OF A SANDY BRAIDED FLOODPLAIN SYSTEM SHOWING SEDIMENT SOURCE AREA IM-

PRINTATION AND SELECTIVE SEDIMENT

MODIFICATION, University of Southern California, Los Angeles. Dept. of Geological Sciences. B. E. Haner.

B. E. Flaner. Sedimentary Geology, Vol. 38, No. 1/4, p 247-261, March, 1984. 8 Fig, 18 Ref.

Descriptors: *Santa Ana River, *Floodplains, *Braided streams, *Sediments, Sediment sources, Sediment modification, Geomorphology, Sediment erosion, Particle, Sedimentation, Channel morphol-

The Santa Ana River floodplain can be divided In e santa Ana River nootopiam can de divisios into five geomorphic environments recognized by both morphology and sedimentary characteristics: braided channels, bars, vegetated islands, sand flats and floodplain terraces. The drainage basin discharge is dominated by the regional Mediterrane climate. The coarse channel sediment reflects the charge is dominated by the regional Mediterranean climate. The coarse channel sediment reflects the large temporal variations in drainage discharge and the resulting greater variability and competence to transport sediment. Major decreases in channel width during both seasonal summer drought and prolonged periodic drought exposes large areas of the floodplain to selective wind winnowing of fluvially derived sediment. This process operates on a small scale today, but during arid conditions in the late Wisconsin interglacial interval (prior to 22,000 yr B.P.) extensive sand flats along the Santa Ana River, distal alluvial fans, and sediment from minor tributaries were the sediment source for a major riverine dune field adjacent to the floodplain. Santa Ana River sediments originate from two distinct geologic provinces: the San Gabriel-San Bernardino granitic and metamorphic complex to the north and the granitic Perris Block to the south. Settling-tube analysis of sediments from tributary streams draining the Perris Block shows a distinctive bimodal distribution characterized by minimal sediment in the very coarse sand size (-1 to 0 phi size) inherited from the granitic grants. minimal sediment in the very coarse sand size (-1 to 0 phi size) inherited from the granitic grus parent material. Transportation results in sediment erosion; sediments are better sorted and finer grained with increasing distance from their source. A particle population is dependent upon grain size distribution at the initial source. Sediment populations are modified by subsequent erosion, selective grain-size transport deposition, and total deposition and mixing of several source areas. (Author's abstract) W85-01735

SEDIMENTATION OF ORGANIC AND INOR-GANIC PARTICULATE MATERIAL IN LINDA-SPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY,

Bergen Univ. (Norway). Inst. of Marine Biology. For primary bibliographic entry see Field 2L. W85-01767

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1982, Geological Survey, Anchorage, AK. Water Resources Div.

P. E. Harrold, and R. L. Burro Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4213, 1983. 53 p, 21 Fig. 35 Tab, 8 Ref.

Descriptors: Bed material, Bed material samplers, *Bedload, Bedload samplers, *Fluvial sediment, Geomorphology, Particle size, River hydraulics, *Sediment discharge, *Sediment load, Sediment transport, Suspended load, *Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-sediment and bedload-transport rates for the Tanana River near Fairbanks can be related to water discharge, and annual sediment loads can be computed using these relations. For a site at Fairbanks the annual loads in 1982 were 26.1 mil-Pairbanks the annual loads in 1962 were 261 mail-lion metric tons of suspended sediment and 227,000 metric tons of bedload. Data collected at five other sites within a 40-kilometer reach of the river indi-cate similar suspended-sediment-transport relations but bedload-transport relations varied from site to site. For all sites bedload is about 1 percent of

Group 2J—Erosion and Sedimentation

suspended-sediment load. Particle-size distribution of suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload ranged from the gravel range to the medium sand range at four of the six sampling sites. At the farthest downstream site, Byers Island, and the farthest upstream site, above Chena River Floodway, median particle size of bedload was always in the sand range. (USGS) W85-01765 W85-01769

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81, Geological Survey, Anchorage, AK. Water Re-

sources Div.
R. L. Burrows, and P. E. Harrold.
Available from OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4064, 1983. 116 p, 42 Fig,
60 Tab, 8 Ref.

Descriptors: *Bed material, Bed material samplers, Bedload, Bedload samplers, Fluvial sediment, Geomorphology, Particle size, River hydraulics, Rivers, Sediments, Sedimentation, Sediment discharge, *Sediment load, *Sediment transport, Supended load, Tanana River, *Alaska, Helley-Smith bedload sampler.

Suspended-ecdiment- and bedload-transport rates for the Tanana River near Fairbanks, Alaska, can be related to water discharge. Annual sediment loads can be computed using these relations. For a site at Fairbanks, the annual loads in 1980 were 22.0 million metric tons of suspended sediment and 272,000 metric tons of bedload; in 1981, 27.3 mil-272,000 metric tons of bedload; in 1981, 27.3 million metric tons of suspended sediment and 333,000 metric tons of bedload passed the Fairbanks site. Data collected at five other locations within a 40 km reach of the river indicate very similar suspended-sediment transport relations, but bedload-transport relations vary from site to site and between 1980 and 1981. For all sites bedload is usually 1 to 1.5 percent of suspended-sediment load. Particle-size distribution for suspended sediment is similar at all six sites. Median particle size is generally in the silt range; only occasionally is it in the very fine sand range. Median particle size of bedload varied from the gravel range to the medium sand range for five of the six sampling medium sand range for five of the six sampling sites in both years. At the sixth site, the most downstream location, median particle size of bedload was in the sand range. (USGS)

DAILY WATER AND SEDIMENT DIS-CHARGES FROM SELECTED RIVERS OF THE EASTERN UNITED STATES: A TIME-SERIES MODELING APPROACH, Geological Survey, Lakewood, CO. Water Re-

Geological Survey, Lakewood, CO. Water Resources Div.
M. J. Fitzgerald, and M. R. Karlinger.
Available from the Distr. Br., USGS, 604 S. Pickett St., Alex, VA 22304. USGS Water Supply Paper 2216, 1983. 24 p, 14 Fig. 7 Tab, 24 Ref.

Descriptors: *Model studies, Statistical models, *Hydrologic data, *Spectral analysis, Time-series modeling, *Sediment discharges, *Atlantic drain-

Spectral and time-domain techniques were applied to daily water and sediment-discharge records from selected rivers of the eastern United States. Time-series models are constructed for analysis of the runoff-sediment yield system. Logarithmic transformation and first-order differencing of the data sets produced second-order, stationary time series and removed seasonal trends. Cyclic models accounted for less than 42 percent of the variance in the water series and 31 percent in the sediment series. Spectral results indicate frequently occurring storm runoff can account for as much as 50 percent of the variation in sediment discharge. Coherence and phase spectra indicate that a linear representation is reasonable for the water-sediment system. Transfer-function models that incorporate water discharge as input prove superior to univarwater discharge as input prove superior to univar-iate techniques in modeling and prediction of sedi-ment yields. The random component that includes

errors in measurement and model hypothesis indi-cates no serial correlation. The unit step-response function, calculated from impulse-response weights, can serve as an index of sediment produc-tion within or between drainage basins. (USGS) 785-01823

EROSION AND SEDIMENTATION CHRONOLOGY OF THREE WATERSHEDS IN MARYLAND, Maryland Univ., College Park. Dept. of Geology. A. V. Segovia, J. D. Foss, D. Fanning, and G.

Demas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207356, Price codes: A07 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Publication No. 77, August, 1983. 126 p, 13 Plates, 13 Tab, 23 Fig. 96 Ref, 3 Append. Project No. OWRT A-058-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: Carbon radioisotopes, *Erosion, *Sedimentation, *Small watersheds, Diatoms, Residual soils, Deposition, Soil horizons, Soil profiles, *Phytoliths, Vertical succession, Deforestation, Cultivation, *Maryland, *Soil erosion.

Three small watersheds located in the Piedmont Three small watersheds located in the Piedmont and Eastern Shore of Maryland were studied. The investigation included descriptions of residual and depositional soils. Buried soil horizons were dated by Carbon-14. In addition, phytoliths were studied to identify the vegetation contemporaneous with the deposition of soil levels. The presence of vertical successions of soil profiles indicate that rates of crossion and redeposition of soils varied in the last cal successions of soil profiles indicate that rates of erosion and redeposition of soils varied in the last thousand years. Noticeable soil horizons were formed during long periods of slow erosion and little deposition, following short intervals of fast erosion and redeposition. Soil erosion was strong after the European contact, as a result of deforestation and intensive agricultural use of the land. The pre-European surface is buried in the lower part of the watersheds to depths of up to 130 centimeters (4+ ft) and the average rate of erosion for the last 300 years is interpreted to have been close to two tons per acre per year. The soil profile for the last 300 years is interpreted to have been close to two tons per acre per year. The soil profile buried under post European-contact sediments indicates a period of moderately fast erosion. The presence of corn phytoliths in this part of the section, the scarcity of grass phytolith and the presence of diatom tests in the soils of a closed depression suggest that erosion was caused by slash-burn methods of agriculture. Thus, the last two episodes of accumulation are ascribed to non-climatic causes in contrast to previous episodes during the Holocene which were probably caused by climatic fluctuations. The study also demonstrated the feasibility of using phytoliths to interpret soil discontinuities in Maryland and to reconstruct past environmental conditions and sequences of dry and wet periods. W85-01835

ESTIMATES OF DISSOLVED AND SUSPEND-ED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,

Geological Survey, Lansing, MI. Water Resources Div.

For primary bibliographic entry see Field 5A. W85-01942

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORA-

DO, Geological Survey, Lakewood, CO. Water Re-

J. G. Elliott, J. E. Kircher, and P. Von Guerard. Available from the OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4141, 1984. 44 p, 9 Fig, 14 Tab, 29 Ref.

Descriptors: *Sediment transport, Annual stream-flow, Flow duration, *Annual sediment load, *Sediment budget, *Colorado, Yampa River, Deerlodge Park, Yampa Canyon, Dinosaur Na-

Discharge measurements and sediment samples were taken at streamflow-gaging station 09260050 Yampa River at Deerlodge Park in 1982 and 1983 were taken at streamflow-gaging station 09/200030 Yampa River at Deerlodge Park in 1982 and 1983 to determine the annual sediment supply to the Yampa Canyon in Dinosaur National Monument. Forty-three years of discharge records at two tributary sites were combined to determine the historic discharge of the Yampa River at Deerlodge Park. A mean annual hydrograph and flow-duration curve were derived from these data. Sediment-transport equations were derived for total sediment-transport equations were derived for total sediment-discharge, suspended-sediment discharge, bedload discharge, and the discharge of sediment in several particle-sizes. Annual sediment discharge were determined by the flow-duration, sediment-rating-curve method and indicated annual total sediment discharge was approximately 2.0 million tons per year of which 0.8 million tons per year. Development of water resources in the Yampa River basin could effect the geomorphic character of the Yampa River at Deerlodge Park and the Yampa Canyon. Several scenarios of altered streamflow ferousers distributions exhaust and the Yampa Canyon. Several scenarios of al-tered streamflow frequency distribution, reduced streamflow volume, and reduced sediment supply are examined to estimate the effect on the sedin budget at Deerlodge Park. (USGS) W85-02045

BOTTOM DYNAMICS IN LAKES.

National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.

Hydrobiologia, Vol. 91, p 9-22, July, 1982. 11 Fig, 2 Tab, 39 Ref.

Descriptors: *Lake sediments, *Bottom sediments, *Bottom sampling, Sediments, Erosion, Entrainment, Wind-driven currents.

A proper understanding of the bottom dynamic conditions (erosion, transportation, accumulation) in lakes is essential in most sedimentological con-texts. Fine cohesive materials generally dominate the open water areas, whereas coarser deposits (sand, gravel) dominate shallow regions where ero-(sand, gravel) dominate shellow regions where ero-sion and transportation of fine materials prevail. At present, there is no physical model available which describes the linkage between the energy content of the water-mass and the capacity for sediment entrainment in open water areas. Water-mass energy depends on, e.g. wind direction, duration, velocity, fetch, and the presence of a thermocline. Patrainment depends on e.g. destity connection. Entrainment depends on, e.g. density, compaction, water and organic content of the sediments and the number and type of bottom fauna. Four different methods are used to determine bottom dynamics. two are size typical and two lake typical. Site and lake typical methods each include one method based on collected field data and one based on theoretical data. One method, the cone apparatus, is presented for the first time. It consists of two cones, one of which has a narrow angle and the other a wide angle, which are zero adjusted at the sediment surface before being released to penetrate sediment surface before being released to penetrate the sediments. The differential cone penetration, refered to as the penetration ratio, is used to indicate the degree of surficial sediment compaction. This simple, inexpensive instrument provides quantitative data on physical sediment characteristics which may be related to bottom dynamic conditions. (Author's abstract) W85-02054

ENTRAINMENT, DEPOSITION, AND TRANS-PORT OF FINE-GRAINED SEDIMENTS IN LAKES,

California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering. W. Lick.

Hydrobiologia, Vol. 91, p 31-40, July, 1982. 12 Fig,

Descriptors: *Entrainment, *Sedimentation, *Lake Erie, Great Lakes, Deposition, Sediment transport, Turbidity, Vertical distribution, Benthic environ-

Erosion and Sedimentation—Group 2J

Recent work on the settling, diffusion, entrainment, and deposition of fine grained sediments in freshwater is reviewed and synthesized. Particular attention is given to the dependence of these processes on sediment properties such as particle size. The application of this knowledge to the analysis and numerical modeling of sediment transport is also discussed. Much of the work is concerned with the Great Lakes, and more specifically, with the Western Basin of Lake Erie. Entrainment experiments have been carried out which demonstrates the second of the sec with the Great Lakes, and more specifically, with the Western Basin of Lake Erie. Entrainment experiments have been carried out which demonstrate that entrainment depends on at least the turbulent stress at the sediment-water interface; water content of the deposited sediments; composition of the deposited sediments; composition of particle-size distribution and organic content; vertical distribution of sediment properties, manner of deposition of sediments; and activity of benthic organisms and bacteria. Particle size variation is a significant factor and because of this the amount of material available for entrainment at a particular stress is finite. The available sediments participate continuously in the entrainment and deposition cycle. Some numerical modeling of sediment transport has been done. Problems arise because sediment properties are highly variable spatially and also with time. Additional research is needed to determine particle collision rates, the probability that particles will adhere after collision, the causes of disaggregation, and the rates at which particles disaggregatio. (Baker-IVI)

PHYSICAL AND GEOCHEMICAL CHARACTERISTICS OF SUSPENDED SOLIDS, WILTON CREEK, ONTARIO,

National Water Research Inst., Winnipeg (Manito

For primary bibliographic entry see Field 2H. W85-02056

SEDIMENTATION IN FLUVIAL AND LACUSTRINE ENVIRONMENTS,

Ottawa Univ. (Ontario). Dept. of Geology. B. R. Rust. Hydrobiologia, Vol. 91, p 59-70, July, 1982. 10 Fig, 1 Tab, 60 Ref.

Descriptors: *Lake sediments, *Stream sediments, *Sedimentation, *Ottawa River, Channeling, Clastic deposition, Mercury, Path of pollutants, Lakes.

Sedimentation in rivers is dominated by a complex set of physical processes associated with the unidir-ectional flow of water. Variations in these process-es give rise to different fluvial channel types, es give rise to different fluvial channel types, whose character can commonly be recognized in the ancient record. Chemical and biological processes are comparatively unimportant in fluvial sedimentation. In contrast, physical, chemical or biological processes can each dominate sedimentation in lakes. Physical (clastic) deposition dominates in high-latitude and mountain lakes (in which chemical and biological activity are low), and in lakes with high relief of the drainage basin and lake floor. Its variety reflects a range of processes influenced by river inflow, wave and current action, thermal and density effects. Economic benefits from the study of lake and river sedimentation include both resource and environmental aspects. An example is given of a mercury pollution study meaue our resource and environmental aspects. An example is given of a mercury pollution study in the Ottawa River, Ottawa. It shows that return to background levels can take place within a relatively short interval after cessation of pollutant input. (Author's abstract) W85-02057

COMPARISON OF SEDIMENT ENERGY-TEX-TURE RELATIONSHIPS IN MARINE AND LA-CUSTRINE ENVIRONMENTS, Canada Centre for Inland Waters, Burlington (On-

tario)

P. G. Sly, R. L. Thomas, and B. R. Pelletier. Hydrobiologia, Vol. 91, p 71-84, July, 1982. 11 Fig, 1 Tab, 37 Ref.

Descriptors: *Sediments, *Lake sediments, *Marine sediments, *Sediment erosion, Sedimentation, Silt, Clay, Erosion.

Sediments in the marine environment are generally subject to higher energy levels than those of lake systems, and lakes are virtually unaffected by tidal range which modifies beach structures formed in response to wave effects. However, despite different energy levels, the textural characteristics of both marine and lacustrine sediments are very similar. The main difference between marine and lacustrine facies is the depth range over which characteristics remain consistent. In lakes, depth limitation may influence the development of surface waves and restrict textural distributions. Simple textural relationships can be used to describe comparable marine and lacustrine sedimentary conditions. Sediments which have been altered by post-depositional erosion, such as lag deposits, or by ice-drop or wind blown settlement, show comparable textural modifications. The settlement of silt and clay particulates, in the marine environment and lakes, may differ slightly because of the chemical differences between salt and fresh water. (Author's abstract) thor's abstract)

LAND USE EFFECTS ON SEDIMENT YIELD AND QUALITY, British Columbia Univ., Vancouver. Dept. of Ge-

For primary bibliographic entry see Field 6G. W85-02060

BASIC CONCEPTS AND ASSOCIATED STA-TISTICAL METHODOLOGY IN THE GEO-CHEMICAL STUDY OF LAKE SEDIMENTS, Geneva Univ. (Switzerland). Inst. F.-A. Forel. J. M. Jaquet, E. Davaud, F. Rapin, and J. P.

Hydrobiologica, Vol. 91, p. 139-146, July, 1982. 4 Fig, 1 Tab, 23 Ref. Vernet.

Descriptors: *Lake sediments, *Sedimentation, *Lac Leman, *Switzerland, Lakes, Sediment transport, Geochemistry, Particle size, Calcium carbon-

A few of the fundamental concepts that underlie geochemical investigations are discussed on the basis of data collected in Lac Leman, Switzerland. Specifics include the carrier substance, the natural background level, the grain-size effects and the areal variability of geochemical associations. The key role played by the statiscal methods in expressing, testing, and refining these concepts is emphasized. Ordination diagrams clearly suggest the existence of several carrier substances in Lac Leman, some of them unsuspected. The need for reliable background levels in environmental geochemistry can be met by expressing them as a simple function of a major sediment constituent, calcium carbonate, in the case of Lac Leman. The use of the complete grain-size spectrum, instead of its moments only, leads to a significant refinement of the notion of grain-size effect. It is now possible to know, by means of a simple correlation analysis, in what size fractions major and minor constituents are most likely to be found. A combination of Rand Q-mode analysis was instrumental in demonstrating the variability of geochemical associations within the lake. Relationships between carrier substances and trace metals can be computed facies by facies, thus avoiding the adverse effect, on the correlation coefficients, of lumping together distinct sub-populations. (Baker-IVI)

CARBON FLOW ACROSS THE SEDIMENT-WATER INTERFACE IN LAKE VECHIEN, THE NETHERLANDS,

Limnologisch Inst., Nieuwersluis (Netherlands). For primary bibliographic entry see Field 2H.

LOADING CONCENTRATION MODELS FOR PHOSPHATE IN SHALLOW LAKES,

Centre d'Ecologie de Camargue (France). For primary bibliographic entry see Field 2H. W85-02067

DIURNAL VARIATION IN THE OXYGEN UPTAKE OF RIVER SEDIMENTS IN VITRO BY USE OF CONTINUOUS FLOW-THROUGH

Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab. For primary bibliographic entry see Field 2E. W85-02069

MASS BALANCE MODELS OF PHOSPHORUS IN SEDIMENTS AND WATER,

Canada Centre for Inland Waters, Burlington (On-

D. C. L. Lam, W. M. Schertzer, and A. S. Fraser. Hydrobiologia, Vol. 91, p 217-225, July, 1982. 8 Fig, 6 Ref.

Descriptors: *Sediment-water interfaces, *Phosphorus, *Model studies, Mass balance models, Sediment transport, Lakes, Lake Erie.

A hierarchy of models is examined and the advantages and disadvantages of increasing their spatial complexity is determined as it relates to mass balance of phosphorus in sediments and water. In addition, the relationships of the results derived from these models are explained with the view that the results from models of progressive complexity are interdependent and can be synthesized into a more comprehensive description of the actual environment than any particular one of them can. As an example, the total phosphorus concentrations in the Western, Central and Eastern Basins of Lake Erie are simulated with the three-box, six-box and multi-box mass-balance models. The emphasis, here, is placed on the effect of thermal stratification and interbasin transport on the settling and sediment return of total phosphorus as the spatial complexity of the model increases. While it is understood that there are several forms or compartments of phosphorus which contribute differently to the total concentration, there are uncertainties associated with the kinetics between the different forms. (Baker-IVI) A hierarchy of models is examined and the advan-

NALYSIS OF TOTAL PHOSPHORUS TRANS-PORT IN RIVER SYSTEMS,

West Virginia Univ., Morgantown. For primary bibliographic entry see Field 2E. W85-02074

MICROBIAL METABOLISM IN SURFACE SEDIMENTS AND ITS ROLE IN THE IMMO-BILIZATION OF PHOSPHORUS IN OLIGO-TROPHIC LAKE SEDIMENTS,

Rhode Island Univ., Kingston. Graduate School of Oceanography.
C. Doremus, and L. S. Clesceri.
Hydrobiologia, Vol. 91, p 261-268, July, 1982. 5
Fig. 2 Tab, 30 Ref.

Descriptors: *Lake sediments, *Oligotrophic lakes, *Phosphorus, *Lake George, *New York, Microorganisms, Metabolism, Organic matter, Detritus, Eutrophication, Anaerobic conditions.

Eutrophication, Anaerobic conditions.

Rapid microbial metabolism and a large phosphorus uptake potential were noted in surface sediments of Lake George, New York. This sediment also exhibited a phosphorus limited condition and a large reservoir of inorganic phosphorus associated with humic substances. These observations suggest that the empirically observed phosphorus retention in oligotrophic lake sediments may be promoted by a rapid cycling of phosphorus between microflora and its associated organic matter. A conceptual model is presented describing phosphorus interactions in surface profundal sediments. Sedimenting organic P settles onto the oxidized sediment where it cycles rapidly within the microbial-detrital complex. Detritovores mobilize phosphorus through excretion and burrow pumping. A significant quantity of phosphate-phosphorus is adsorbed onto the biodetrital complex. This adsorbed pool is part of the biodetrial P buffering capacity because it participates as an intermediary between microbial biomass and inorganic phosphorus. Non-adsorbed inorganic phosphorus probably becomes sequestered

Field 2—WATER CYCLE

Group 2J-Erosion and Sedimentation

in ferric hydroxide compounds. Biodetritus in the reduced sediments tends to be less microbially reduced sediments tends to be less microbially active and less efficient due to anaerobic metabolism. This phenomenon and the lack of an iron sequestering mechanism causes phosphate to accumulate in deep sediments and diffuse upward. As a lake proceeds along the eutrophication continuum, phosphorus release in anoxic eutrophic sediments may be attributed to phosphorus inputs to the sediments in quantities that are greater than the buffering capacity of the biodetritus. The shift from an aerobic to an anaerobic metabolism in surface sedimentary biodetritus may also aid in the loss of retentive efficiency in eutrophic lake sediments. (Baker-IVI)

PHOSPHATE ADSORPTION KINETICS OF RESUSPENDED SEDIMENTS IN A SHALLOW LAKE, NEUSIEDLERSEE, AUSTRIA, Vienna Univ. (Austria). Limnologische Lehrkan-

For primary bibliographic entry see Field 2H. W85-02079

PARTICLE SIZE DISTRIBUTION AND CHEM-ICAL PARAMETERS OF THE SEDIMENTS OF A SHALLOW TURBID IMPOUNDMENT, A SHALLOW TORBID IMPOUNDMENT, Orange Free State Univ., Bloemfontein (S Africa). Dept. of Botany. For primary bibliographic entry see Field 2H. W85-02082

INTERACTION BETWEEN INTERSTITIAL WATER AND SEDIMENT IN TWO CORES OF LAC LEMAN, SWITZERLAND, Geneva Univ. (Switzerland). Dept. of Inorganic, Analytical and Applied Chemistry. For primary bibliographic entry see Field 2H. W85-02084

VERTICAL STRATIFICATION IN SEDIMENTS FROM A YOUNG OLIGOTROPHIC SOUTH AFRICAN IMPOUNDMENT: IMPLICATIONS IN PHOSPHORUS CYCLING, Natal Univ., Pietermaritzburg (South Africa). Natai Univ., Pietermantzburg (South Ar Dept. of Botany. For primary bibliographic entry see Field 2H. W85-02086

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CON-CENTRATION-DEPTH PROFILES, Freshwater Biological Association, (England). For primary bibliographic entry see Field 2K. W85-02090

DEEPWATER SEDIMENTS AND TROPHIC CONDITIONS IN FLORIDA LAKES, Florida State Museum, Gainesville. For primary bibliographic entry see Field 2H. W85-02099

SEDIMENTATION RATES IN A SWISS-ITAL-IAN LAKE MEASURED WITH SEDIMENT

TRAPS,
Commission of the European Communities, Ispra Communities, Ispra (Italy). Joint Research Centre. G. Premazzi, and G. Marengo. Hydrobiologia, Vol. 92, p 603-610, July, 1982. 4 Fig. 5 Tab, 26 Ref.

Descriptors: *Tripton, *Sedimentation, *Lake Lugano, *Italy, *Switzerland, Mineralization, Stratification, Phosphorus, Nitrogen, Organic carbon, Diffusion, Decomposition, Lake sediments,

Tripton sedimentation was investigated in the eutrophic Lake Lugano (Ponte Tresa basin) from October 1979 to October 1980. The annual amount of tripton collected was 748 g/sq m/y. Phosphorus, nitrogen and organic carbon fluxes into the hypolimation were estimated to be 1.9, 16.2 and 121 g/sq m/y respectively. Mineralization rates into

the trophogenic layer varied from 11% to 19% per day during summer stratification. The regeneration processes contribute about 60% of the calculated P deficit in the epilimnion. The tripton is decom-posed mostly in the metalimnion, out of the eupho-tic zone; from here the phosphorus is carried back to the number of the phosphorus of the contribution of the contr to the overlying waters by diffusion proces (Author's abstract) W85-02100

EFFECTS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN

Ministry of Irrigation, Cairo (Egypt). Research Inst. of High Dam Side Effects. For primary bibliographic entry see Field 4A. W85-02101

CLIMATIC AND ANTHROPOGENIC EFFECTS ON THE SEDIMENTATION AND GEOCHEM-ISTRY OF LAKES BOURGET, ANNECY AND

LEMAN, Geneva Univ. (Switzerland). Inst. F.-A. Forel. For primary bibliographic entry see Field 2H. W85-02102

STANDARDIZATION OF METHODS OF ANALYSIS FOR HEAVY METALS IN SEDI-MENTS,

Institute for Soil Fertility, Groningen (Nether-For primary bibliographic entry see Field 5A. W85-02104

SEDIMENT CONCENTRATIONS FROM IN-TENSIVELY PREPARED WETLAND SITES, Clemson Univ., SC. Belle W. Baruch Forest Sci-For primary bibliographic entry see Field 4C. W85-02112

OBJECTIVE IDENTIFICATION OF POOLS AND RIFFLES, State Univ. of New York at Buffalo. Dept. of Geography.
For primary bibliographic entry see Field 2E.
W85-02159

2K. Chemical Processes

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM, Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre. For primary bibliographic entry see Field 5B. W85-01635

VEGETATION AND WATER CHEMISTRY OF FOUR OLIGOTROPHIC BASIN MIRES IN NORTHWESTERN ONTARIO, Alberta Univ., Edmonton. Dept. of Botany. For primary bibliographic entry see Field 2H. W85-01648

STATISTICAL ANALYSIS AND EVALUATION OF WATER-QUALITY DATA FOR SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA, Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 5B. W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUI-FER IN COASTAL SOUTHWEST FLORIDA. Geological Survey, Tallahassee, FL.

W. C. Steinkamnf Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: \$4.75 in paper copy, \$3.50 in microfiche. USGS Water Resources Investigations Report 82-4052, 1982. 34 p, 13 Fig, 7 Tab, 36 Ref. Descriptors: *Geochemistry, *Water quality, *Groundwater, *Saline water, Aquifers, Carbonate rocks, Diagenesis, Distribution, Salinity, *Florida, Floridan aquifer, Charlotte County, De Soto County, Lee County, Manatee County, Sarasota

Twenty-three ground-water samples from the Floridan aquifer in coastal southwest Florida show Floridan aquifer in coastal southwest Florida show that water quality deteriorates to the south and west. The waters grade from a fresh calcium mag-nesium bicarbonate sulfate type to a very saline sodium magnesium chloride type downgradient. Bromide-chloride and specific conductance ratios indicate that dilution of marine-like ground water is a signigicant mechanism in the evolution of the different water types found. Calcium, magnesium, and bicarbonate concentrations occur within a rel-atively narrow range and are primarily a fjunction atively narrow range and are primarily a function of mineral equilibria. Magnesium and strontium concentration distributions suggest several mineral-water interactions, including aragonite inversion, incongruent solution of magnesium calcite to a lower magnesian form, and dedolomitization. Sullower magnessan form, and decolomization. Sui-fate concentrations increase downgradient and evince gypsum-anhydrite solution, particularly in the fresher waters. The extent to which each factor affects dissolved specie concentrations is a function of the location of the water in the flow system. W85-01778

HYDROGEOCHEMICAL INVESTIGATION OF THERMAL SPRINGS IN THE BLACK CANYON-HOOVER DAM AREA, NEVADA AND ARIZONA,

Nevada Univ. System, Reno. Water Resources

W. A. McKay, and D. E. Zimmerman Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202472, Price codes: A04 in paper copy, A01 in microfice, Publication 41092, November 1983, 40 p, 10 Fig. 2 Tab, 36 Ref. Project No. OWRT A-100-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Thermal water, *Colorado River, *Stable isotopes, *Chemical analysis, *Thermal springs, Geochemistry, *Tritium, Chemical geothermometry, Nevada, Arizona, Black Canyon.

An estimated 80 liters/sec. of spring flow dis-charges from both sides of the Colorado River in Black Canyon, Nevada, and Arizona. The springs issue primarily from the highly faulted and fractured volcanic rocks which are exposed through-out the canyon from Hoover Dam to 9.5 kilomeout the canyon from Hoover Dam to 9.5 kilometers downstream. Chemical analysis of the spring waters, including environmental isotope and tritium results, indicate a variety of possible origins. Possible source waters include, in order of estimated importance, recirculated Lake Mead water, regional groundwaters from the north, west, and east, deep circulating hydrothermal fluids, and locally recharged groundwaters. Observed surface temperatures range from 24 C to 62 C. Total dissolved solids values range from 500 mg/l to 3600 mg/l. Tritium concentrations range from < 5 T.U. to 116 T.U. While thermodynamic calculations indicate oversaturation of these waters with respect to several silicate and carbonate minerals, the occasional absence of secondary mineral deposits suggests a potentially young system.

SHORT-TERM CHANGES IN THE BASE NEUTRALIZING CAPACITY OF AN ACID ADIRONDACK LAKE, NEW YORK,

Syracuse Univ., NY. Dept. of Civil Engineering. For primary bibliographic entry see Field 5B. W85-01917

DISTRIBUTION OF SELECTED CHEMICAL CONSTITUENTS IN WATER FROM THE FLORIDAN AQUIFER, SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT, Geological Survey, Tallahassee, FL. Water Resources Div.

Estuaries—Group 2L

For primary bibliographic entry see Field 7C. W85-01928

GROUND WATER IN THE REDDING BASIN, SHASTA AND TEHAMA COUNTIES, CALI-FORNIA.

Geological Survey, Menlo Park, CA. Water Resources Div.

For primary bibliographic entry see Field 4B. W85-01945

SINGLET OXYGEN IN SURFACE WATERS -PART I: FURFURYL ALCOHOL AS A TRAP-PING AGENT, Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland).

W. R. Haag, J. Hoigne, E. Gassman, and A. M.

Chemosphere, Vol. 13, No. 5/6, p 631-640, 1984. 5 Fig, 29 Ref. Swiss National Science Foundation Project 2.027-0.81.

Descriptors: *Oxygen, *Trapping, *Furfuryl alco-hol, *Natural waters, Water analysis, Photochemi-cal reactions, Oxidants, Oxidation-reduction poten-tial, Chemical reactions.

A comparison was made between the product distributions obtained with Black Lake humic acid and rose bengal as a test of the intermediacy of singlet oxygen in humic acid photosensitized oxygenation of furfuryl alcohol (FFA). The HPLC analyses showed that peaks due to phosphate and humic acid were too small to interfere, and that the product distributions, were the same both in the product distributions were the same both in the Black Lake humic acid and the rose bengal sensitized systems. These facts, together with the observations that no oxygen consumption occurred in the irradiated solutions in the absence of either FFA or sensitizer, constitutes sizeable evidence for the integradiacy of simplet oxygen in these seasons. FFA or sensitizer, constitutes sizeable evidence for the intermediacy of singlet oxygen in these reac-tions. Singlet oxygen concentrations in natural waters exposed to sunlight are most easily deter-mined by adding a low concentration of acceptor and following its first order rate of consumption. FFA is recommended as a highly soluble, efficient trapping agent for singlet oxygen determinations in natural waters. (Baker-IVI) W85-01964

SINGLET OXYGEN IN SURFACE WATERS -PART II: QUANTUM YIELDS OF ITS PRO-DUCTION BY SOME NATURAL HUMIC MA-TERIALS AS A FUNCTION OF WAVE-

LENUIH, Eidgencessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland). W. R. Haag, J. Hoigne, E. Gassman, and A. M.

Braun. Chemosphere, Vol. 13, No. 5/6, p 641-650, 1984. 5 Fig, 2 Tab, 12 Ref. Swiss National Science Foundation Project 2.027-0.81.

Descriptors: *Oxygen, *Water analysis, *Natural waters, *Dissolved solids, Chemical reactions, Photochemical reactions.

Quantum yields of singlet oxygen production by natural aquatic organic matter decrease with in-creasing wavelength, indicating that calculations assuming a constant quantum yield measured at a singlet short wavelength can overestimate the singlet short wavelength can overestimate the steady state singlet oxygen concentrations in sunlit surface waters by more than a factor of 2. Isolated humic acids exhibit peaks in singlet oxygen production at longer wavelengths than natural dissolved organic materials suggesting that compounds other than humics are also responsible for singlet oxygen production in natural waters. Various methods of measurement suggest that singlet oxygen concentrations in the unore few centimes. ous methods of measurement suggest that singlet oxygen concentrations in the upper few centimeters of natural surface waters under noon, spring or fall Swiss sunlight lie in the range of 1-3 x 10 to the minus 14 M per mg/L dissolved organic material. Half-lives of reactive organics are a few days to a few hours. Reaction with singlet oxygen will be an important degradation pathway for relatively few micropollutants. (Baker-IVI) W85-01965

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON, Geological Survey, Tacoma, WA. Water Re-sources Div.

For primary bibliographic entry see Field 7C. W85-02043

ALGAL-AVAILABILITY OF PARTICULATE PHOSPHORUS FROM DIFFUSE AND POINT SOURCES IN THE LOWER GREAT LAKES

BASIN, Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering. T. C. Young, and J. V. DePinto. Hydrobiologia, Vol. 91, p 111-119, July, 1982. 6 Fig. 5 Tab, 24 Ref. EPA grant R-806817-01.

Descriptors: *Phosphorus, *Great Lakes, *Algal growth, *Algae, Phytoplankton, Productivity, Aquatic productivity, Nutrients, Bioassay,

Control of phytoplankton production in the Great Lakes can be achieved most efficiently by limiting inputs of biologically available P. We report the results of studies performed to characterize the chemical forms and availability of particulate P in wastewater and tributaries which enter the lower Lakes, the eroding bluffs which border Lake Erie, and bottom samples from the near-shore of western Lake Erie. Rates of release of available P were estimated from a simple first-order model of the process, as observed during algal bioassays. Available P in wastewater samples, as a fraction of total particulate P, was affected minimally by wastewater treatment, including chemical precipitation and filtration; it correlated well with levels of total particulate P. Available particulate P levels in fluvial suspended sediments showed regional uniformity, but appeared to be strongly dependent on levels of both NaOH-P and CDB-P. Rates of release of available P decreased during wastewater on levels of both NaOH-P and CDB-P. Rates of release of available P decreased during wastewater treatment to values which were similar in magnitude to those observed for fluvial sediments. Release rates, however, were not related to any of the particulate P fractions which were measured. Analysis of the bluff and bottom samples indicated that P availability in the former was negligible, but the latter contained levels which approached those of wastewater particulates, though available P was released from the bottom sediments at relatively low rates. (Author's abstracts)

W85-02061

TRANSPORT OF IRON AND MANGANESE IN RELATION TO THE SHAPES OF THEIR CONCENTRATION-DEPTH PROFILES, Freshwater Biological Association, Windermere (England).

W. Davison.
Hydrobiologia, Vol. 92, p 463-471, July, 1982. 5 Fig, 31 Ref.

Descriptors: *Iron, *Manganese, *Sediments, *Transport, *Model studies, Redox boundary, Concentration gradient, Oxidation, Chemical re-duction, Interstitial water.

A model is presented which describes the transport of iron and manganese in the vicinity of a redox boundary. It is based on input of a particulate component, to form a point source, from which soluble species diffuse along a concentration gradient. The shapes of concentration-depth profiles in marine and freshwater sediments and water columns are reviewed and discussed in terms of the model. Transport, either entirely within a water column or within the sediment, may be simply treated because the rate of vertical transport can be regarded as constant. The discontinuity in the rate of vertical transport which occurs at the sediment-water interface can provide a complicated example of the model, especially when it coincides with the redox boundary. Authigenic mineral formation processes can modify the model, sometimes to such an extent that it becomes invalid. This particulary true for soluble iron profiles on organically rich marine sediments. Sampling interval is critical to the regulate, profile shapes and must be calevant to true for soluble iron profiles on organically rich marine sediments. Sampling interval is critical to the resultant profile shape and must be relevant to

the particular environment, e.g. meters in water columns and millimeters in sediments. The differences in the rate of reduction and oxidation of iron and manganese tend to modify both the position of the profile with respect to the redox-cline and its stage of development in a seasonally anoxic system. It is these factors which determine why most of the iron which reaches a sediment is permanently incorporated whereas manganese is re-released. This mechanism determines the average ratio of iron to manganese in sedimentary rocks. The development of peaked profile shapes in water columns implies that under certain conditions dissolved iron and manganese may be transported columns implies that under certain continuous un-solved iron and manganese may be transported from the waters of the sediment. (Author's ab-W85-02090

INFLUENCE OF SIMULATED GROUNDWAT-ER-MOVEMENT ON THE PHOSPHORUS RE-LEASE FROM SEDIMENTS, AS MEASURED IN A CONTINUOUS FLOW SYSTEM, Amsterdam Univ. (Netherlands). Lab. voor Micro-

biologie. For primary bibliographic entry see Field 2F. W85-02094

MOTION OF TWO COMPRESSIBLE FLUIDS WITH INTERFACE IN A POROUS RESER-

Department of Scientific and Industrial Research, Wellington (New Zealand). Applied Mathematics Div. For primary bibliographic entry see Field 2F. W85-02154

2L. Estuaries

SOILS OF SWAMPS IN THE APALACHICOLA, FLORIDA, ESTUARY, C. L. Coultas.

Florida Scientist, Vol. 47, No, 2, p 98-107, 1984. 3 Fig, 3 Tab, 15 Ref.

Descriptors: *Apalachicola estuary, *Florida, *Swamps, *Soil types, Wetlands, Estuaries, Sulfa-quents, Sulfihemists, Fluvaquents, Acidic soils, Sa-linity, Conductivity, Clays, Soil classification.

Until recently, forested wetlands in Florida were classified as miscellaneous land types or as broadly defined soil series. Selected soils in swamps of the Apalachicola, Florida estuary were sampled and analyzed. Three great groups, Sulfihemists, Sulfaquents, and Fluvaquents were found. These soils were wet, moderately acid, high in clay content, and low in salinity. Conductivity values increased from the surface decursed to the surface. from the surface downward because the surface tends to be frequently flushed with rain and river tenus to be frequently flushed with rain and river waters resulting in a dilution of salts. Kaolinite, vermiculite, quartz, and mica were the principal clay-sized minerals. Decisions concerning agro-nomic utilization of these soils should be carefully made because of their high potential acidity, low-bearing strength, and frequent flooding. (Collier-IVI) IVI) W85-01641

MODELING ESTUARINE NUTRIENT GEO-CHEMISTRY IN A SIMPLE SYSTEM,

Florida State Univ., Tallahassee. Dept. of Ocean ography. L. W. Kaul, and P. N. Froelich, Jr.

Geochimica et Cosmochimica Acta, Vol. 48, No. 7, p 1417-1433, July, 1984. 13 Fig, 4 Tab, 87 Ref.

Descriptors: "Cycling nutrients, "Estuarine envi-ronment, "Geochemistry, "Model Studies, "Nutri-ents, "Ochlockonee Bay, "Florida, Primary pro-duction, Phosphorus, Nitrogen, Silica, Phosphates, Nutrient removal, Estuaries.

A model of estuarine nutrient fluxes through a simple estuary over a one-year period demon-strates that estuaries are geochemical transformers that enchance the reactive fluvial phosphate flux to the oceans (by activation of fluvial particulates) and pass the fluvial silica flux unaltered. The model

Field 2—WATER CYCLE

Group 2L—Estuaries

was applied to 39 nutrient (P, N, Si) profiles collected over a 14-month period in the pristine river/estuary, Ochlockonee Bay, Florida. Each profile is deconvolved into three component functions: linear mixing (conservative), first-order removal (biological productivity), and parabolic input (regeneration). After correction for temporal variations in the fluvial end-members, the model provides quantitative estimates of total estuarine primary production, net regeneration, and subsequent fluxes to the ocean over a year-long period. The modeled data set is internally self-consistent: virtually all the phosphorus and silica removed during primary production is quickly returned to the water column by regeneration and enters the ocean. One-third of the fluvial reactive-P enters the estuary as particles whose phoaphate is released after deposition in estuarine sediments. About 20% of the dissolved fluvial silica flux is removed biologically; all of this biogenic silica dissolves in the estuary and enters the ocean. Neather the season of the dissolved fluvial silica flux is removed biologically; all of this biogenic silica dissolves in the estuary and enters the ocean. Neather the ocean is enters and escapes the bay in unmeasured forms (as NH4 or via denitrification to N2 and N2O). In the Ochlockone, biological productivity removes nutrients in the ratios N:P approximately = 9:1 and Si-P approximately = 9:1 and Si-P approximately = 20:1. The Bay is an inefficient nutrient recycler due to its small size and rapid washout rates. (Collier-IVI)

CHANGES IN THE FISH FAUNA OF THE FORMER FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971, For primary bibliographic entry W85-01765

TRANSPORT OF DISSOLVED ORGANIC TRANSPORT OF DISSOLVED ORGANIC CARBON THROUGH A MAJOR CREEK OF THE NORTH INLET ECOSYSTEM, Texas Univ. at Arlington. Dept. of Biology. T. H. Chrzanowski, L. H. Stevenson, and J. D.

Spurrier.
Marine Ecology - Progress Series, Vol. 13, No. 2/3, p 167-174, August, 1983. 6 Fig, 5 Tab, 26 Ref. NSF grant DEB 7683010.

Descriptors: *Organic carbon, *Dissolved solids, *Town Creek, *South Carolina, Solute transport, Marshes, Tidal waters, Spartina, Nutrients.

Sampling was at a transect across Town Creek in the North Inlet Ecosystem, South Carolina. The creek drains much of the northern section of a 3200 ha salt marsh and forms a large section of the marsh inlet. Samples were collected every 1.5 h for 50 consecutive hours during neap tides (4 tidal cycles) and 50 consecutive hours during corresponding spring tides of each season. Dissolved organic carbon (DOC) concentrations were variable, ranging from 0.9 to 13.0 g/cu m of water with as much as 2.5 g/cu m of water variation during a 1.5 h period. There was no apparent trend toward higher DOC concentrations during spring tides. DOC was exported from the marsh during each sampling period. Net transports ranged from approximately 5 to 480 g DOC/s. Annual budgets revealed a DOC export as high as 7.5 +/-1.8 x 10 to the 9th g C/yr corresponding to 416 g DOC/sq. Myr. Net exports of DOC and TOC (total organic carbon) correspond to 91% and 117% of the Sparing medical pools of the sparing medical pools. m/yr. Net exports of DOC and TOC (total organic carbon) correspond to 91% and 117% of the Spar-tina production, which is not reasonable. Either Spartina may not be the most of the sparting Spartina may not be the most important input of DOC to the system, or the sampling scheme used in this study generated transport estimates that could not be reliably extended to annual budgets. (Moore-IVI)

SEDIMENTATION OF ORGANIC AND INOR-SEDIMENTATION OF ORGANIC AND INOR-GANIC PARTICULATE MATERIAL IN LINDA-SPOLLENE, A STRATIFIED, LAND-LOCKED FJORD IN WESTERN NORWAY, Bergen Univ. (Norway). Inst. of Marine Biology. P. Wassmann.

Marine Ecology - Progress Series, Vol. 13, No. 2/ 3, p 237-248, August, 1983. 5 Fig. 5 Tab, 77 Ref.

Descriptors: *Particulate matter, *Lindaspollene, *Norway, *Sedimentation, Fjords, Organic matter,

Organic carbon, Mineralization, Organic nitrogen, Diatoms, Zooplankton.

Sedimentation of particulate material to the bottom (90 m) was measured in Lindaspollene, a land-locked, highly stratified, west Norwegian fjord, receiving fresh water from a small glacier free watershed. Five cylindrical sediment traps positioned at 10, 20, 40, 70, and 85 m below the surface were exposed from April to November. Organic material comprised 40 to 60% of the sedimented matter. Sedimentation rates of particulate inorganic material (PIM) and particulate organic carbon (POC) decreased from 229 and 111 at 20 m to 71 and 22 g/sq m/yr, respectively, in the deeper water. Possible reasons for the low sedimentation in the stagnant water below 40 m are high mineralization rates in the upper 40 m and the lack of resuspension in the water below. Three pulses of POC and PON (particulate organic nitrogen) reached the bottom related to phytoplankton blooms in April and May. The pulse in April was the largest and the sedimented material consisted of unidentified aggregates, diatoms and some few fecal pellets. Few recognizable structures were found in the samples below 20 m except in April. This might indicate a low zooplankton grazing efficiency in April, but a high efficiency during the rest of the investigation period. (Author's abstract) W85-01767

FLUXES OF HEAVY METALS IN DELAWARE RIVER FRESHWATER TIDAL WETLANDS, Rider Coll., Lawrenceville, NJ. Dept. of Biology. For primary bibliographic entry see Field 5B. W85-01805

RECENT VERTICAL ACCRETION RATES AT BLACKWATER WILDLIFE REFUGE, Maryland Univ., College Park. Dept. of Geography. M. S. Keaeney, S. P. Leatherman, and G. T. F.

M. S. Keseney, S. F. Leatnerman, and G. T. F. Wong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190107, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 78, August 1983. 43 p, 8 Fig, 3 Tab, 17 Ref, 2 Append. Project No. OWRT A-064-MD(1), Contract/Grant No. 14-34-0001-2122.

Descriptors: *Accretion, Tidal marshes, Sedimentation rates, Lead radioisotopes, Organic matter, Sea level rise, Peat, Density, *Maryland, Blackwater National Wildlife Refuge.

Vertical accretion rates and sediment composition analyses were determined for Scirpus olneyi-dominated marshes near Shorter's Wharf Road in the Blackwater National Wildlife Refuge. Pb210 activity profiles of two cores from backmarsh sites suggest that long-term marsh accretion rates (ranging from 1.7 mm/yr to 3.6 mm/yr have not kept up with the local rate of sea level rise of 3.87 mm/yr. Organic carbon and bulk density napluses democratical profiles. with the local rate of sea level rise of 3.87 mm/yr. Organic carbon and bulk density analyses demonstrated that accumulation of organic matter is the primary accretionary mechanism in these marshes. However, marsh loss is probably not so much a function of inorganic sediment starvation, but the result of the slow burial and decay of older peat

RIVER ELBE: PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCH-LORINES DURING ESTUARINE MIXING, Nederlands Inst. voor Onderzoek der Zee, Texel. For primary bibliographic entry see Field 5B. W85-01836

RIVER WESER PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCH-LORINES DURING ESTUARINE MIXING, Nederlands Inst. voor Onderzoek der Zee, Texel. For primary bibliographic entry see Field 5B. W85-01837

ONE-DIMENSIONAL MIXING AND FLUSHING MODEL OF THE EMS-DOLLARD ESTU-

ARY: CALCULATION OF TIME SCALES AT DIFFERENT RIVER DISCHARGES,

Nederlands Inst. voor Onderzoek der Zee, Texel. W. Helder, and P. Ruardij. Netherlands Journal of Sea Research, Vol. 15, No. 3/4, p 293-312, December, 1982. 12 Fig, 2 Tab, 19 Ref.

Descriptors: *Estuaries, *Ems-Dollard Estuary, *Mixing, *Flushing, River flow, Tidal effects, Model studies, Salinity.

Model studies, Salinity.

The Ems-Dollard estuary is situated at the Dutch-German border, and is part of the Wadden Sea, characterized by channels and extensive tidal flats. Of the total surface area 40 to 50% consists of tidal flats, in the Dollard, 80%. The tidal prism of the estuary as a whole is about 1100 million cubic meters. The tide is semidiurnal and mean tidal amplitude about 3 m. Starting from longitudinal salinity distributions over the years 1970 to 1977 it was shown that the flushing time decreases with increasing river flow. At average discharge the flushing time of Ems water was found to be 38 days and that of Westerwoldse Aa water within the Dollard 14 days. By segmentation of the Ems-Dollard estuary in 17 compartments a box model was constructed that can be used to predict the dispersion of water and dissolved constituents. Comparison of the distribution of water types as calculated by the box model are in agreement with independent calculations from using fluorescence and salinity as tracers. Comparison of model-predicted and measured salinity distribution show reasonable agreement. Turn-over times, mean ages and residence times are calculated and it is shown that these time scales vary with fresh water discharge too. (Baker-IVI) that these time scales vary with fresh water dis-charge too. (Baker-IVI)

USE OF A MODEL TO ASSESS FACTORS AFFECTING THE OXYGEN BALANCE IN THE WATER OF THE DOLLARD,

Biologisch Centrum, Haren (Netherlands) F. B. Van Es, and P. Ruardij. Netherlands, Journal of Sea Research, Vol. 15, No. 3/4, p 313-330, December, 1982. 8 Fig, 1 Tab, 24

Descriptors: *Estuaries, *Mixing, *Flushing, *Model studies, *Ems Estuary, *Dollard, Oxygen balance, Seasonal variation, Primary productivity,

A mathematical model was developed to calculate the contribution of several processes to the oxygen balance in the water of the Dollard, the inner part of the Ems Estuary. This model was based on a mixing and flushing model for the calculation of the dispersal of organic wastewater discharged to the Dollard. Measured data were available of background and total oxygen consumption and primary production in the water, sediment respiration and decomposition rates of the organic waste. This enabled a mean reaeration coefficient to be estimated. The model satisfactorily described the distribution of oxygen concentrations in the Dollard, both in time and space. In summer, the oxygen balance was determined to be the same amount by sediment respiration and oxygen consumption in the water, and in autumn largely by the waste discharges. The physical process of reaeration was the predominant oxygen providing process, though in summer primary production was important. The input of oxygen-rich water from the middle part of the estuary was of minor importance. During the input of oxygen-rich water from the middle part of the estuary was of minor importance. During the highest waste water discharges the oxygen consumption in the mouth of the Dollard was 4 times the background level. Beyond that area the increase was negligible. (Baker-IVI) W85-01839

PHOSPHORUS DISTRIBUTION IN SEDI-MENTS OF THE DELAWARE RIVER ESTU-

Delaware Univ., Newark. Dept. of Geology. R. N. Strom, and R. B. Biggs. Estuaries, Vol. 5, No. 2, p 95-101, June, 1982. 4 Fig. 2 Tab, 34 Ref.

Descriptors: *Phosphorus, *Sediments, *Delaware River Estuary, Estuarine environment, Salinity, Iron oxyhydroxide, Clay, Calcium carbonate.

Iron oxyhydroxide, Clay, Calcium carbonate.

In order to determine the primary factors related to the accumulation of phosphorus in estuarine sediments, a study of phosphorus fractions in sediments of the Delaware River Estuary was undertaken. A correlation matrix between the phosphorus fractions, determined by serial extraction, and 14 sediment variables was computed. Total phosphorus and total inorganic phosphorus in the sediment-phosphorus reservoir decreases with increasing salinity. This variation is correlated with decreasing iron oxyhydroxide content in the sediment. Neither clay content nor calcium carbonate content appear to be significantly correlated with variation in total inorganic phosphorus content in the fine-grained sediments of this estuary. Although calcium phosphate is concluded to be a major constituent of the sediment-phosphorus reservoir, there was no evidence found that it is authigenic in this environment. (Author's abstract) W85-01843

TIDAL AND SEASONAL VARIATIONS OF SULFATE ION IN A NEW JERSEY MARSH SYSTEM.

Kean Coll. of New Jersey, Union. Dept. of Chemistry-Physics.

For primary bibliographic entry see Field 5B. W85-01848

TROPHIC RESPONSE OF FISHES TO HABI-TAT VARIABILITY IN COASTAL SEAGRASS SYSTEMS.

Florida State Univ., Tallahassee. Dept. of Biological Science.

Cal Science.

R. J. Livingston.

Ecology, Vol. 65, No. 4, p 1258-1275, August, 1984. 7 Fig, 5 Tab, 57 Ref, 2 Append. EPA grant R-805288010.

Descriptors: *Fish, *Estuarine environment, *Habitats, *Water pollution effects, Water temperature, Pulp wastes, Storm runoff, Fish food, Fish behavior, Seagrasses, Environmental effects, Water quality, Macrophytes, Phytoplankton.

Shallow coastal areas of the northeast Gulf of Mexico are physically unstable in terms of short-term, seasonal, and year-to-year changes in temperature, salinity, nutrient concentration, and other water quality features. A 9-yr comparison was made of two estuaries, one polluted and one in the natural state, to determine the response of fish assemblages to habitat alteration in space and time. During the study period, extreme natural habitat changes due to storm water runoff and low winter temperatures were superimposed over water quality changes (increased color, turbidity, nutrients; reduced dissolved oxygen) associated with release of pulp mill effluents. Various grassbed fishes followed regular seasonal, age-specific feeding patterns, which did not change substantially in terms of qualitative foods composition in the unpolluted estuary over a 7-yr period of observation. Such feeding behavior helped to explain temporally conservative cycles of relative abundance despite extreme (natural) habitat change. Anthropogenous habitat alterations, though seemingly slight, were associated with reductions in benthic macrophyte distribution, enhanced phytoplankton productivity, and changes in the relative dominance and numerical abundance of associated fish assemblages. Grassbed species were replaced by plankton-feeding fishes, and disruption of feeding habits of various species toward those observed in the unaffected estuary, although such recovery varied from species to species according to habitat utilization and trophic needs. From these results, it is clear that a relative-ly complex coastal seagrass system exposed to periodic, extreme natural disturbance is relatively resilient to such changes in terms of relative dominance and 600 web structure. However, apparently slight water quality changes due to pollution,

which are outside the evolutionary experience of the biotic components, can cause serious disruptions of the basic habitat structure, energy flow, and community composition of the grassbed assemblages at various levels of biological organization. (Author's abstract) W85-01890

226RA AND 228RA IN THE MIXING ZONES OF THE PEE DEE RIVER-WINYAH BAY, YANGTZE RIVER AND DELAWARE BAY ES-TUARIES.

South Carolina Univ., Columbia. Dept. of Geolo-

gy. R. J. Elsinger, and W. S. Moore. Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 601-613, June, 1984. 5 Fig. 1 Tab, 22 Ref. NSF grants OCE-81-10405 and OCE-82-44535.

Descriptors: *Radium radioisotopes, *Estuarine environment, *Yangtze River, *China, *Pee Dee River, *Winyah Bay, *Delaware Bay, Desorption, Salinity, Sediments, Dilution, Diffusion, Mixing zone.

Ra-226 and Ra-228 have non-conservative excess concentrations in the mixing zones of the Pee Dee River-Winyah Bay estuary, the Yangtze River estuary, and the Delaware Bay estuary. Laboratory experiments, using Pee Dee River sediment, indicate desorption of Ra-226 to increase with increasing salinities up to 20%. In Winyah Bay desorption from river-borne sediments could contribute almost all of the increases for both isotopes. Desorption adds only a portion of the excess Ra-228 measured in the Yangtse River and adjacent Shelf waters and Delaware Bay. In the Yangtze River the mixing zone extends over a considerable portion of the Continental Shelf where Ra-228 is added to the water column by diffusion from bottom sediments, while Ra-226 concentrations decrease from dilution. Diffusion of Ra-228 from bottom sediments in Delaware Bay primarily occurs in the upper part of the bay (< 22% water) where fine grained sediments predominate. A diffusive flux for Ra-228 of 0.33 dpm/sq cm year was determined for Delaware Bay. (Author's abstract) W85-01912

BEHAVIOR OF ORGANICALLY-BOUND IRON IN SEAWATER OF ESTUARIES, Hokkaido Univ., Hakodate (Japan). Faculty of Fisheries.

K. Matsunaga, K. Igarashi, S. Fukase, and H. Tsubota.

Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 615-622, June, 1984. 8 Fig, 19 Ref.

Descriptors: *Red tide, *Iron, *Estuarine environment, *Salinity, *Hakodate Bay, *Osaka Bay, *Japan, Eutrophication, Primary productivity, Flocculation, Phytoplankton, Heavy metals.

Two rivers and estuaries were selected for experiments on organically bound iron. The Kunebetsu River has its origin in Lake Ohnuma, and the river flows into Hakodate Bay. The estuary has normal primary production and no pollution. The other river is the Yodo River, which flows into Osaka Bay. The bay is contaminated with heavy metals and nutrients, and the estuary has red tide outbreaks during the summer. In Hakodate Bay, the iron complex decreases with increasing salimity because of its flocculation. In Osaka Bay, the iron complex as well as nutrients except silicate are completely assimilated by phytoplankton. Among nutrients, silicate diffuses only by water mixing because the main species of phytoplankton were green colored algae at the river mouth. High nitrite concentration was found at about 15% salinity. This means that both phytoplankton decomposition and photosynthesis occur. The iron complex assimilated would be released to seawater with the decomposition of phytoplankton and then red tide outbreaks at the estuary would continue for a long period. (Moore-IVI) W85-01913

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND),

Marine Biological Association of the United Kingdom, Plymouth (England).

For primary bibliographic entry see Field 5B.

W85-01914

HYDROCARBONS IN WASHINGTON COAST-AL SEDIMENTS.

Washington Univ., Seattle. School of Oceanography. For primary bibliographic entry see Field 5B. W85-01915

BENTHIC PHOSPHORUS REGENERATION IN THE POTOMAC RIVER ESTUARY, Geological Survey, Reston, VA. E. Callender.

E. Callender. Hydrobiologia, Vol. 92, p 431-446, July, 1982. 6 Fig, 47 Ref.

Descriptors: *Potomac River, *Estuaries, *Phosphorus, *Sediment-water interface, Phosphates, Sediments, Benthos, Estuarine environment, Primary production, Iron oxides, Interstital water, Cycling nutrients.

The flux of dissolved reactive phosphate from Potomac riverine and estuarine sediments is controlled by processes occurring at the water-sediment interface and within surficial sediment. In situenthic fluxes (0.1 to 2.0 mmoles/sq m/day) are generally five to ten times higher than calculated diffusive fluxes (0.020 to 0.30 mmoles/sq m/day). The discrepancy between the two flux estimates is greatest in the transition zone (river mile 50 to 70) and is attributed to macrofaunal irrigation. Both in situ and diffusive fluxes of dissolved reactive phosphate from Potomac tidal river sediments are low while those from anoxic lower estuarine sediments are high. The net accumulation rate of phosphorus in benthic sediment exhibits an inverse pattern. Thus a large fraction of phosphorus, which contain a surficial oxidized layer and oligochaete worms tolerant of low oxygen conditions, and a large fraction of phosphorus is released from anoxic lower estuary sediments. Tidal river sediment pore waters are in equilibrium with amorphous Fe(OH)3 while lower estuary pore waters are significantly undersaturated with respect to this phase. Benthic regeneration of dissolved reactive phosphorus is sufficient to supply all the phosphorus requirements for net primary production in the lower tidal river and irver and transition-zone waters of the Potomac River Estuary. Benthic regeneration supplies approximately 25% as much phosphorus as inputs from sewage treatment plants and 10% of all phosphorus inputs to the tidal Potomac River. When all available point source phosphorus data are put into a steady-state conservation of mass model and reasonable coefficients for uptake of dissolved phosphorus, remineralization of particulate phosphorus in the water column is obtained for the summer of 1980. (Author's abstract) was course simulation of dissolved and particulate phosphorus in the water column is obtained for the summer of 1980. (Author's abstract)

METHANE PRODUCTION IN MINNESOTA PEATLANDS,

Minnesota Univ., Navarre. Gray Freshwater Biological Inst.

R. T. Williams, and R. L. Crawford. Applied and Environmental Microbiology, Vol. 27, No. 6, p 1266-1271, June, 1984. 1 Fig, 6 Tab, 20 Ref.

Descriptors: *Peat, *Methane, *Methane, Methanogenesis, Temperature, Hydrogen ion concentration, Metabolism, Dissolved gases.

Rates of methane production in Minnesota peats were studied. Surface (10- to 25-cm) peats produced an average of 228 mmol of CH4 per g (dry weight) per h at 25 degrees C and ambient pH. Methanogenesis rates generally decreased with depth in ombrotrophic peats, but on occasion were

Group 2L—Estuaries

observed to rise within deeper layers of certain fen peats. Methane production was temperature dependent, increasing with increasing temperature (4 to 30 degrees C), except in peats from deep layers. Maximal methanogenesis from these deeper regions occurred at 12 degrees C. Methane production rates were also pH dependent. Two peats with pHs of 3.8 and 4.3 had an optimum rate of methanogenesis, and an experimental production at pH 6.0. The addition to peat of glucose and H2-CO2 stimulated methanogenesis, whereas the addition of acetate inhibited methanogenesis. Cysteine-sulfide, nitrogen-phosphorustrace metals, and vitamins-yeast extract affected methane production very little. Various gases were found to be trapped or dissolved (or both) within peatland waters. Dissolved methane increased linearly to a depth of 210 cm. The accumulation of metabolic end products produced within peat bogs appears to be an important mechanism limiting carbon turnover in peatland environments. (Author/s abstract) thor's abstract)

RELATIVE CONTRIBUTIONS OF BACTERIA AND FUNGI TO RATES OF DEGRADATION OF LIGNOCELLULOSIC DETRITUS IN SALT-MARSH SEDIMENTS, Georgia Univ., Athens. Dept. of Microbiology. R. Benner, S. Y. Newell, A. E. Maccubbin, and R. E. Hodson.

Applied and Environmental Microbiology, Vol. 48, No. 1, p 36-40, July, 1984. 3 Fig. 2 Tab, 24 Ref. NSF grant OCE-8117834 and Dept. of Commerce grant NA 80AA-D-00091.

Descriptors: *Salt marshes, *Bacteria, *Fungi, *Decomposition, *Lignocellulose, Detritus, Microorganisms, Mineralization, Wetlands, Spartina.

organisms, Mineralization, Wetlands, Spartina.

Specifically radiolabeled (C-14 lignin)lignocellulose and (C-14 polysaccharide)lignocellulose from the salt-marsh cordgrass Spartina alterniflora were incubated with an intact salt-marsh sediment microbial assemblage, with a mixed (size-fractionated) bacterial assemblage, and with each of three marine fungi, Buergenerula spartinae, Phaeosphaeria typharum, and Leptosphaeria obiones, isolated from decaying S. alterniflora. The bacterial assemblage alone mineralized the lignin and polysaccharide components of S. alterniflora lignocellulose at approximately the same rate as did intact salt-marsh sediment insocala. The polysaccharide component safter 23 days of incubation, ca. 10% of the lignin component and 20% of the polysaccharide component of S. alterniflora lignocellulose were mineralized. Relative to the total sediment and bacterial inocala, the three species of fungi mediated only very slow mineralization of the lignin and polysaccharide components of S. alterniflora lignocellulose. Experiments with uniformly C-14 labeled S. alterniflora material indicated that the three fungi and the bacterial assemblage were capable of degrading the non-lignocellulosic fraction of S. alterniflora niflora material indicated that the three fungi and the bacterial assemblage were capable of degrading the non-lignocellulosic fraction of S. alterniflora material, but only the bacterial assemblage signifi-cantly degraded the lignocellulosic fraction. The results suggest that bacteria are the predominant degraders of lignocellulosic detritus in salt-marsh sediments. (Author's abstract) W85-02138

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

EVALUTION OF HOLLOW FIBER ULTRAFIL-TRATION AS A PRETREATMENT FOR RE-VERSE OSMOSIS DESALINATION OF SEA-WATER,

RAILES, Romicon, Inc., Woburn, MA. B. R. Brealau, A. J. Testa, and B. M. Kilcullen. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212406, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, (1984). 164 p. 106 Fig. 41 Tab.

Project No. OWRT C-80309-S(8558)(1), Contract/ Grant No. 14-34-0001-8558.

Descriptors: Membranes, *Ultrafiltration, *Pre-treatment, Membrane processes, Reverse osmosis pretreatment, *Desalination.

An intensive study was conducted at the Wrights-ville Beach Test Facility to evaluate the perform-ance of hollow fiber ultrafiltration membranes as a pretreatment for seawater desalination via reverse osmosis. Several polymer types were evaluated to determine the best ultrafiltration membrane. In addition, two different fiber diameters (20 and 43 mil) onton, two different noer chameters (20 and 45 min) were studied to investigate the effects of flow through the hollow fiber cartridge on flux, cleaning, and membrane life. The results from these tests show that the polysulfone PM-50 membrane (50,000 M.W. cutoff) which has a 43 mil internal diameter is well suited for seawater pretreatment. Various cleaning chemicals (sodium hydroxide, sodium hypochlorite, citric acid, surfactant types, etc.) were evaluated in several combinations of operating modes (reverse flow, backflush) to optimize the members were from the Economic politics. mize the membrane performance. Economic analyses show that the three inch diameter, 26.5 square foot PM-50 hollow fiber cartridge can pretreat seawater at a cost of approximately one dollar per thousand gallons of seawater produced using a totally automated system. W85-01830

3B. Water Yield Improvement

DEVELOPING THE RESOURCE POTENTIAL OF A SHALLOW WATER TABLE,

California Univ., Davis. Dept. of Land, Air and Water Resources.

D. W. Grimes, and D. W. Henderson D. W. Grimes, and D. W. Henderson.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-207315,
Price codes: A04 in paper copy, A01 in microfiche.
Water Resources Center Completion Report,
April, 1984. 63 p, 14 Fig. 15 Tab, 36 Ref, 1
Append. Project No. OWRT B-216-CAL(1), Contract/Grant No. 14-34-0001-1210.

Descriptors: *Shallow water, *Evapotranspiration, *Water budget, *Irrigation scheduling, *Soil salinity, *Water salinity, *Plant water status, Perched water, Irrigation management, California, San Joaquin Valley.

Observations and estimates indicate that shallow water table encroachment affects increasingly large areas of agriculturally productive land in the large areas of agriculturally productive la large areas of agriculturally productive land in the central and western San Joaquin Valley. With current management techniques, the present drain and disposal facilities are inadequate to effectively handle the water volume that moves through soils and becomes a part of the shallow water system. In the presence of active plant roots, soil water is depleted in upper profile zones with the establishment of a potential gradient sufficient to effect upward capillary water movement in the presence of a shallow water table. A three-year study was done to evaluate the resource potential of shallow-perched water tables as a resource to meet cropdone to evaluate the resource potential of shallow-perched water tables as a resource to meet crop evapotranspiration (ET) requirements. Using water-budget and chlorine-tracer techniques inde-pendently to measure shallow water table contri-butions to crop ET revealed that as much as 50 to 60 percent of crop ET could be met by the shallow of percent of crop E1 count of mer of the snanow water table. The amount of water contributed by the shallow water table was strongly conditioned by water table salinity and depth to the shallow water. Study results show the need for a title management system approach for effective utiliza-tion of the resource potential of shallow water tables in contrast to specific entities considered in isolation. (Snyder-California) W85-01832

APPROPRIATE WATER SUPPLY TECHNOL-OGY FOR DEVELOPING COUNTRIES,

For primary bibliographic entry see Field 5F.

DRINKING WATER IN DEVELOPING COUNTRIES - THE MINIMUM TREATMENT PHILOSOPHY. A CASE STUDY,

Norconsult A/S, Sandvika (Norway). J. A. Myhrstad, and O. Haldorsen. Aqua, No. 2, p 86-90, 1984. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Water quality control, *Developing countries, *Bacteria, *Water supply development, Drinking water, Water management, Water resources development, Sanitation.

A priority list is presented of items to be considered in selection of water sources. Selection of proper sources combined with proper intake arrangements and the introduction of sanitary zones requiring the simplest possible treatment methods should be an appropriate approach to a safe and sound water quality policy, referred to here as the minimum treatment philosophy. The study presented deals with specifics for water supply to the Kigoma Region in Tanzania. In this region it is bacteriological rather than chemical quality of the water which is a problem. Virtually all surface water sources (both existing and potential) are heavily polluted by bacteria regardless of the intake location. Consequently, all surface water sources should have their bacteriological quality improved prior to delivery to consumers. The source selection process in Tanzania should first consider use of waters not requiring disinfection: deep groundwater, properly protected shallow groundwater and properly protected shallow groundwater and properly protected springs; low-turbidity waters which can be directly disinfected including lakes and headwater reaches of streams; water requiring treatment prior to disinfection including streams and rivers and other sources that cannot be immediately disinfected or that require treatment for other reasons; and finally, water that cannot be treated by conventional means to comply with standards such as those containing high sulfates, mitrates, fluorides and other problems. (Baker-IVI) W85-02018

WATER BALANCE AND CROPS IN KARNA-

TAKA,
Andhra Univ., Waltair (India). Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 2I.
W85-02127

3D. Conservation In Domestic and Municipal Use

RESTORATION OF FAILING ON-SITE WASTEWATER DISPOSAL SYSTEMS USING

WASTEWATER DISPUSAL SYSTEMS USING WATER CONSERVATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 5D. W85-01656

STATE LAWS MANDATING WATER CONSER-VATION, Maryland Univ., College Park. Dept. of Geogra-

For primary bibliographic entry see Field 6E. W85-01806

RESULTS AND EXPERIENCE OF THE GREIZ WATER-SUPPLY DISTRICT IN THE FIELD OF RATIONAL WATER USE (ERGEBNISSE UND ERFAHRUNGEN DES VERSORGUNGS BEREICHS GREIZ BEI DER RATIONELLEN WASSERVERWENDUNG),

U. Koschmieder, H. Tunger, and L. Hoffmann. Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 37-39, February, 1984. 2 Fig.

Descriptors: *Water conservation, *Greiz, *East Germany, Water treatment, Wastewater treatment, Water management, Drinking water, Economic as-pects, Water pollution control.

The Greiz water-supply district, German Demo-cratic Republic, has chosen to implement rational

water use particularly by reducing water losses and by preventing water wastage. The basis for this plan was information exchange with other facilities, party policy on rational water use including the 1982 water law, and the Colbitz experience. Goals of the plan are a stable drinking-water supply, sewer system, and wastewater treatment; optimal use of available funds; savings in and return of investment; increasing worker productivity; reducing energy use and costs; instituting order and stability; and guaranteeing environmental protection while relieving the demands made on water as a natural resource. The main means of implementing the plan are to reduce water losses together with water demand within the district, to reduce the volume of drinking water used for industrial purposes, to decrease pollution by wastewater and recycle valuable chemicals, and to ensure adequate water quantity and quality. The means of achieving these ends include direction by the party organization within each facility, ideological and subject-specific instruction of workers and users; translation of results of technological and scientific studies into practice; participation of youth, innovators, and inventors; and close cooperation with water-management professionals in the district. (Gish-IVI) anagement professionals in the district. water-mana (Gish-IVI) W85-01880

STATUS OF RESEARCH AND DEVELOP-MENT IN WATER SUPPLY SYSTEMS IN INDIA, National Environmental Engineering Research Inst., Nagpur (India). V. Raman, and B. B. Sundaresan. Aqua, No. 1, p 19-22, 1983. 28 Ref.

Descriptors: *India, *Research priorities, *Water conveyance, *Operating policies, Administrative agencies, Water conservation, Metropolitan water management, Water management, Rural areas, Management planning, Leakage.

Until recently in India, it was not realized that research and development efforts in water supply systems should focus on conservation of water, energy and resources, simplicity of construction and maintenance, and operation without sacrificing water quality. Research and development has mostly concentrated on modifications to, development of, and innovations in the existing systems. Detailed field evaluation of selected rural water supply schemes are being carried out with the Detailed field evaluation of selected rural water supply schemes are being carried out with the following objectives: to identify technological, or-ganizational, adminstrative, financial, and socio-cultural factors that have contributed to the suc-cess, or lack of success, of the schemes so as to provide proper feed-back for future planning, design, and implementation of rural water supply programs. A single agency is needed at state level with its functions decentralized at district level, to look after financial administrative and technical with its functions decentralized at district level, to look after financial, administrative, and technical matters at state level and execution and mainte-nance at district level. Design criteria and specifi-cations need to be revised to suit regional needs. In a survey of water distribution systems in cities and towns of India, it was determined that 20-35% of total flow in the systems is lost through leakage; the expenditure on a preventive maintenance program for the systems could be recovered in 12-18 months, based on the quantum of water saved. (Collier-IVI)
W85-01982

LEAKAGE CONTROL,

Water Supply Association, London International Water Supply Asso (England). L. R. Bays. Aqua, No. 1, p 51-55, 1984. 5 Ref.

Descriptors: *Leakage, *Water loss, *Water supply, Water conservation, Economic aspects, Costs, Resources development, Water resources development, Resources management.

Leakage or loss of water between source and con-sumer has been a cause for concern in many coun-tries of the world for a long time. Water supplies all over the world are becoming increasingly aware of the need to make the fullest use of avail-able water resources before investing money into

further resources which may be of doubtful quality. International funding agencies require the reduction of high losses from systems before agreeing to financial help to develop new sources. The paper will attempt to outline the many aspects of leakage control with emphasis on an economical approach to the subject. The purpose of leakage control is to reduce consumption and the reduction of consumption also involves the reduction of waste' involving the education of consumers in their daily habits. It is therefore necessary to define the terms used in waste reduction quite carefully so that everyone has an understanding of what is meant and the paper will attempt to clarify terms used which are often misunderstood. The financial benefits of reducing consumption must be balanced against the cost of achieving such reductions. Water undertakings employing some techniques at present can often put their existing resources to more efficient use with resultant benefits. (Author's abstract) abstract) W85-02016

3F. Conservation In Agriculture

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTH-WESTERN NEW MEXICO, PHASE II, New Mexico State Univ, Las Cruces. Dept. of Agricultural Engineering.
C. E. Kallsen, E. J. Gregory, and T. W. Sammis. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195866, Price codes: A09 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute Technical Report No. 155, Las Cruces, October 1982. 180 p, 31 Fig, 61 Tab, 25 Ref, 6 Append. Project No. OWRT C-90229-G(9444)(2), Contract/Grant No. 14-34-0001-9444.

Descriptors: *Evaporation, *Transpiration, *Eva-potranspiration, Water use efficiency, Evapotran-spiration potential, Nitrogen, *New Mexico, Water requirements, Plant growth rates, Irrigation, Crop yield, Barley, Beans, Alfalfa.

The water requirement for growth of spring barley, pinto beans, and alfalfa was investigated in northwestern New Mexico. Results strongly sugest that the level of nitrogen fertility does not alter the water-use efficiency (WUE) of spring barley when WUE is expressed as a function of transpiraton. WUE may change, depending on irrigation scheduling, if WUE is expressed as a function of evapotranspiration. We attribute this difference to differential soil-water evaporation. Further evidence supports the hypothesis that a common function exists independent of season, with respect to a given crop, relating economic yield to transpiration. Crop coefficients based on various methods of calculating potential evapotranspiration were found to vary considerably, as much as 50 percent, of calculating potential evapotranspiration were found to vary considerably, as much as 50 percent, between years due in part to the difference in the evaporation component of the measured evaporation component of the measured evaporation. Caution should be exercised in using crop coefficients to predict alfalfa, pinto beans and spring barley seasonal or intra-seasonal water requirements when the crops are grown under conditions requiring frequent light irrigation.

W85-01817

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER, Arizona Univ., Tucson. Dept. of Plant Sciences. For primary bibliographic entry see Field 5D. W85-01869

WATER CONSERVATION THROUGH LIMIT-ED IRRIGATION OF CORN AND GRAIN SOR-GHUM IN THE GREAT PLAINS, Nebraska Univ.-Lincoln. Dept. of Agricultural En-

D. G. Watts, C. Y. Sullivan, W. F. Kroutil, and R.

J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207372.
Price codes: A05 in paper copy, A01 in microfiche.
Completion Report, (1984). 67 p, 43 Fig. 7 Tab.
Project No. OWRT B-054-NEB(1), Contract/
Grant No. 14-34-0001-0230.

Descriptors: *Water conservation, Water availabil-ity, *Evapotranspiration control, *Crop response, *Water yield improvement, Crop yield, Water stress, Farm management, *Irrigation efficiency, Great Plains, Corn, Grain sorgh

The overall purpose was to conduct agronomic and economic evalution of the potential of limited irrigation of corn and grain sorghum for conserving and extending water supplies in the central Great Plains. A high linearity was found in the relationship between yield and evapotranspiration (ET) with both crops. The maximum yields in 1981 were obtained with less ET than in 1980, and the slope for yield reductions with decreased ET (limited irrigation) was greater in 1980 than in 1981. Higher mean relative humidity in 1981 may have ited irrigation) was greater in 1980 than in 1981. Higher mean relative humidity in 1981 may have contributed to this. When a factor was added to account for the effect of the relative humidity, the yield reductions became nearly constant. When ET-yield functions were normalized and expressed on a relative basis, the slopes for all varieties of a specific crop and at a particular location were very smillar. In fact, the slopes for corn and sorghum were also similar for locations and years. However, on an actual vield-ET basis, differences in general were any summar for focations and years. However, on an actual yield-ET basis, differences in genotypes were apparent. Since project data shows the yield-ET regression is usually linear, a water supply which fails to meet the conditions for full ET demand would be expected to reduce yields. The rate reduction or along of the regression, and The rate reduction, or slope of the regression, may differ with environment, crop and variety. At higher ET values, corn equaled or exceeded sorum yields. W85-01952

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INVESTMENT SCHEDULING INCORPORAT-ING DRAINAGE WATER REUSE.

Cairo Univ., Giza (Egypt). Dept. of Irrigation and Hydraulics.

M. N. Allam, and D. H. Marks. Water Resources Research, Vol. 20, No. 7, p 757-766, July, 1984. 3 Fig, 15 Tab, 33 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Water reuse, *Investment scheduling, Agricultural development, Optimization, Mathematical models, Drainage systems, Economies of scale, Irrigation water, Water quality.

Agricultural expansion planning in developing countries where there is extensive government involvement in the planning process can be defined in a two-level heirarchy. At the first level, the role of the agricultural expansion investment in achiev-ing the strategic goals of the sector is to be deter-mined. At the second level, analysis of the agricultural expansion is to be carried out in such a way that the strategic decisions from the first level can be implemented. The focus of this paper is on the analysis of investment scheduling, the major issue of the second level. A mathematical optimization of the second level. A mathematical optimization model is built to aid in analyzing the scheduling problems of land development, crop selection, drainage water reuse, and capacity expansion of the irrigation and drainage networks. A minimum cost criterion is used, where costs of land development, farming, irrigation and drainage infrastructures, maintenance and operations, and pump stations are considered. The model has a nonlinear tions are considered. The model has a nonlinear objective function to account for economies of scale and linear and nonlinear constraints. A fixed charge approximation is used for the nonconvex cost functions, and a mixed integer programming algorithm along with an enumeration procedure is used for solving the model. The solution procedure guarantees global optimality for the approximated problem. A hypothetical expansion of 70,000 acres (28,350 ha) based on data from the Nile Delta in Egypt is used as a case study to illustrate the procedure under different conditions of irrigation water quality. (Author's abstract) vater quality. (Author's abstract) W85-02142

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: INCOME REDISTRIBUTION OBJECTIVE,

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

Cairo Univ., Giza (Egypt). Dept. of Irrigation and

M. N. Allam, and D. H. Marks.

Water Resources Research, Vol. 20, No. 7, p 767-774, July, 1984. 1 Fig. 13 Tab, 17 Ref.

Descriptors: *Developing countries, *Irrigation, *Planning, *Income redistribution, Agricultural development, Economic aspects, Optimization, Mathematical models.

The role of agricultural expansion investment in improving the income redistribution conditions in society has been of considerable concern to planers. In this paper an approach based on distributing the newly developed land to a poorer sector (landless farmers) in society to gain agricultural revenues and improve their income is investigated. A mathematical optimization model is built to de-termine the distribution of land and a pricing policy established for the new areas in such a way that (1) a specified (by the government) inc that (1) a specified (by the government) income increase to the farmers can be achieved, (2) a predetermined level of recovery of the expansion cost can be insured, (3) high agricultural efficiency in the new land can be maintained, and (4) redistribution benefits can be maximized. In a case study application of the model, no conflict is found b application of the model, no conflict is found ob-tween the economic efficiency and income redistri-bution critieria in agricultural expansion invest-ment within the planning framework presented in the companion paper (Allam and Marks, this issue). For a specified cost recovery condition it is found that the location and the second control of the confound that the least cost planning alternatives give the opportunity to the largest number of landless farmers to own the new land and receive a specified income increase from the agricultural revenues, but a conflict between government return from the investment and redistribution objectives is found. This conflict is addressed and the trade-off between the two objectives is illustrated. (Author's WRS-02143

REAL TIME IRRIGATION SCHEDULING VIA 'REACHING' DYNAMIC PROGRAMMING.

Colorado State Univ., Fort Collins. Dept. of Civil

S. Pleban, D. F. Heermann, J. W. Labadie, and H. R. Duke.

Water Resources Research, Vol. 20, No. 7, p 887-895, July, 1984. 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Irrigation scheduling, *Computer models, *Real time, High Plains, Soil water, Costs, Dynamic programming, Optimization.

A large number of farm operations in the High Plains states have surface irrigation systems sup-plied by wells pumped at a fixed discharge rate. The scheduling of irrigations for such systems can be challenging if the farmer desires to avoid crop yield reduction due to insufficient soil moisture yield reduction due to insufficient son moisture while minimizing irrigation costs. A dynamic pro-gramming model is formulated for determining surface irrigation schedules over the short term that minimize irrigation labor costs while meeting that minimize irrigation abor costs white meeting crop requirements under a limited water supply. The model is capable of solving high-dimensional problems by a 'reaching' forward algorithm that defines a surrogate state by using binary decision policies rather than by discretization of the actual state variables. Data from the Northern Colorado state variables. Data from the Northern Colorado Research Demonstration Center were used for testing the viability of the algorithm and its practi-cal usefulness for irrigators through simulated real time experiments. The model optimized the sched-uling of nine field groups divided into a total of 24 fields. An 8% savings in irrigation costs resulted for two years, as compared with conventional scheduling, while maintaining acceptable soil mois-ture levels. Sizeable savings are potentially avail-able through extension to large systems. (Moore-IVI) W85-02155

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD-PLAIN MANAGEMENT PROGRAM IN RAPID CITY, SOUTH DAKOTA, South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
For primary bibliographic entry see Field 2E.
W85-01643

FLOOD ELEVATIONS FOR THE SOLEDUCK RIVER AT SOL DUC HOT SPRINGS, CLAL-LAM COUNTY, WASHINGTON, Geological Survey, Tacoma, WA. Water Re-Geological Survey, Tacoma, sources Div.

Available from the OFSS, USGS, Box 25424, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4083, 1983. 17 p, 9 Fig, 1 Tab, 3 Ref.

Descriptors: Flood control, Maximum probable floods, *Flood peaks, Flood plain zoning, *Sole-duck River, Clallam County, *Washington, 100-

Elevations and inundation areas of a 100-year flood of the Soleduck River, Washington, were determined by the U.S. Geological Survey for the area in the vicinity of the Sol Duc Hot Springs resort, a public facility in the Olympic National Park that under Federal law must be located beyond or protected from damage by a 100-year flood. Results show that most flooding could be eliminated by raising parts of an existing dike. In general, little flood damage is expected, except at the southern end of an undeveloped airstrip that could become inundated and hazardous due to flow from a tributary. The airstrip is above the 100-year flood of the Soleduck River. W85-01773

STREAMFLOW CHARACTERISTICS OF THE YELLOWSTONE RIVER BASIN, MONTANA, THROUGH SEPTEMBER 1982,

Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 2E. W85-01781

IMPROVEMENT OF FLOOD-FREQUENCY ESTIMATES FOR SELECTED SMALL WATER-SHEDS IN EASTERN KANSAS USING A RAIN-

FALL-RUNOFF MODEL, Geological Survey, Lawrence, KS. Water Re-sources Div. For primary bibliographic entry see Field 2A. W85-01786

PREDICTION OF PEAK FLOWS FOR CUL-VERT DESIGN ON SMALL WATERSHEDS IN

VERT DESIGN ON SMALL WATERSHEDS IN OREGON, Oregon State Univ., Corvallis. School of Forestry. A. J. Campbell, R. C. Sidle, and H. A. Froehlich. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212398, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute Publication WRRI-74, Oregon State Univ., Corvallis, January 1982. 96 p, 1 Fig. 5 Tab, 65 Ref. 4 Append. Project No. OWRT A-053-ORE(1), Contract/Grant No. 14-34-0001-1139.

Descriptors: *Flood frequencies, *Culverts, *Culvert design, *Flood peaks, *Peak flows, Watersheds, Forest engineering, Flood prediction, *Oregon, Forested watersheds, Small watersheds.

Forest engineers must estimate flood frequencies for very small watersheds when designing culvert installations. Empirical formulae and simplified

rainfall runoff models require considerable judgement to give reasonable results. As an alternative, this study presents equations to predict peak flows on small watersheds in Oregon. Equations were developed from 80 watersheds ranging in size from 0.21 to 10.60 square miles. Six physiographic regions were used, based on previous flood frequency studies. In each region, annual peak flows from gaging stations with 20 or more years of record were analyzed using four flood frequency distributions (Gumbel, two-parameter log-normal, three-parameter log-normal, log Pearson type III). Log Pearson type III distribution was found suitable for all regions, based on the chi-square goodness of fit all regions, based on the chi-square goodness of fit test. Floods with recurrence intervals of 10, 25, 50 and 100 years were related to physical and climatic and 100 years were related to physical and climatic indices of drainage basins by multiple regression analysis. Basin area was most important in explaining the variation of flood peaks in all regions. Mean basin elevation and mean annual precipitation were also significantly related to flood peaks in two regions in western Oregon. Equations to predict the 25-year flood were developed for each physiographic region. Average percent error for predict the 25-year flood were developed for each physiographic region. Average percent error for these regression equations ranged from 16.1 to 64.1 percent, the smaller errors being associated with the more humid regions. Confidence limits for the equations provide estimates of prediction uncertainties over the range of design flows. These equations provide a better basis for culvert design of small forested watersheds than rule of thumb or empirical methods. W85-01820

REPORT ON HYDROELECTRIC POWER UTI-LIZATION AND RESERVED-WATER PROB-LEMS (BERICHT UBER WASSERKRAFTUNT-ZUNG UND RESTWASSERPROBLEME).

Wasser, Energie, Luft, Vol. 75, No. 3, p 45-74, 1983. 13 Fig, 2 Tab, 14 Ref. (in German and

Descriptors: *Hydroelectric power, *Switzerland, *Reserved water, Hydroelectric plants, Construction, Costs, Electric power production, Water allocation, Economic aspects.

Switzerland is heavily dependent on other countries for its energy supply; in 1980, only one fifth of its energy was produced domestically, and of this, 90% was hydroelectric power (HEP). Expansion of HEP facilities can raise production somewhat, but will not cover the expected increase in electricity demand. Preparatives before hereigning conity demand. Preparations before beginning con-struction of a medium-sized HEP plant take at least 6-8 yr, and construction requires a further 4-6 yr. An important criterion for assessing the suitability of a site is cost of production, though the necessity of covering demand is becoming increasingly im-portant. In most cases, an HEP plant makes special use of public waters, for which the local authority must grant a concession in which all conditions are specified and which runs for 80 yr at most. The cost structure of an HEP facility is based on fixed costs; annual production costs have a minor influ-ence on total annual cost. Electricity cost is only slightly dependent on market mechanisms. Utiliza-tion of HEP requires extensive construction and investments, which influence the economy, employment, water management, the environment, and the ecosystem. Any water diverted from the stream used by the HEP facility (reserved water) means a reduction in energy production and a rise in cost per kWH as well as the necessity for another compensating energy source. Conditions for utilization of reserved water should be specified in the water concession, and failure to comply should result in penalty. Other consequences of reserved water use are lower water taxes paid by the HEP plant to the authority, higher energy costs for the consumer, and inability to operate optimally for the HEP facility. In the long term, the coological and land-use benefits derived from reserved-water use must be weighed against the environmental and economic disadvantages caused by the production of compensatory energy. (Gish-IVI) W85-01855

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Control Of Water On The Surface—Group 4A

TASKS OF THE DAM KEEPER (LES TACHES DU GARDIEN DE BARRAGE),

Bureau d'Ingenieurs-Conseils, La land).

Wasser, Energie, Luft, Vol. 76, No. 3/4, p 44-47, 1984. 2 Fig.

Descriptors: *Reservoir operation, *Dam keepers, *Legal aspects, Personnel, Maintenance.

The legal duties of the owner of a dam regarding control of its operation are reviewed, and the The legal duties of the owner of a dam regarding control of its operation are reviewed, and the relations existing between all persons and organizations involved in supervision. The main duties of a dam keeper are: visual observation of the operation and the surroundings; execution of control measures; control and maintenance of the measurement installation and the control galleries. The qualities necessary in a dam keeper are: a sense of responsibility; initiative, ability to work independently; precision in work; and the ability to draft simple messages. (Moore-IVI)

W85-01859

RESULTS OF SURFACE-WATER, DYKE, AND COASTAL INSPECTION – WAYS TOWARD MORE EFFECTIVE INSPECTION FOR THE FUTURE

E. Clausnitzer.

Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 2-3, January, 1984.

Descriptors: *Inspection, *Surface waters, *Dykes, *Coastal areas, *East Germany, Legal aspects, Monitoring, Water facilities, Water quality.

The German Democratic Republic Guideline for Capacity, Duties, Composition, and Method of Operation of the Inspection Commission came into effect as part of the 1982 Water Law and stresses the high level of responsibility of local councils for the monitoring of surface-water condition, use, and conservation and of the functional capacity of water facilities in their area. In fall 1982, 16,000 workers performed 4,100 water, dyke, and coastal inspections; over 20,000 workers from all sections of the population as well as representatives of workers performed 4,100 water, dyke, and coastal inspections; over 20,000 workers from all sections of the population as well as representatives of government and social organizations carried out more than 5,800 inspections during both spring and fall 1983. In 1983, 77% of surface waters, 99% of dykes, and 90% of water facilities were inspected versus 70, 90, and 75%, respectively, in 1982. Functional capacity was satisfactory for 97.4% of surface waters, 99.6% of dykes, and 98.6% of water facilities in fall 1983, compared with 95.3, 98.7, and 95.9%, respectively, in spring 1983. In the first six months of 1983, the number of citations for unsatisfactory conditions are rectified in 1982. Unsatisfactory conditions are rectified in order of importance using measures decided upon at the time of inspection. The participation of lay people in inspections has led to a greater sense of responsibility for water quality. The quality of inspection must be improved by participation of members of the forestry and agricultural communities, experienced citizens, and representatives of environmental organizations. (Gish-IVI) W85-01874

SHALLOW GROUND-WATER FLOW AND DRAINAGE CHARACTERISTICS OF THE BROWN DITCH BASIN NEAR THE EAST UNIT, INDIANA DUNES NATIONAL LAKESHORE, INDIANA, 1982,

Geological Survey, Indianapolis, IN. Water Resources Div.

sources Div.

R. J. Shedlock, and W. E. Harkness.

Available from the OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4271, 1984. 37 p, 14 Fig, 8

Ref.

Descriptors: *Drainage ditches, *Groundwater, Hydrologic models, *Indiana, Lake Michigan, Na-tional Parks, Organic soils, *Sand aquifers, *Un-confined aquifers, Water table decline, Wetlands, Drainage-ditch maintenance, Porter County, *Streambed gradients, The Pines.

Brown ditch drains wetlands between three parallel ridges of sand dunes near the East Unit of Indiana Dunes National Lakeshore in Poter County, Indiana. Dune and lacustrine sands form a surficial aquifer that is the source of base flow to the ditch. Profiles established in July and August 1982 show that the average streambed slope of the ditch in the Lakeshore (0.19 percent) is six times that of the upstream east reach in the adjacent town, The Pines (0.03 percent). Although the ditch contains debris and vegetation, the reach in the Lakeshore seems to convey all the base flow it receives. In contrast, the upstream east arm contains several ponded sections where flow is sluggish. Digital model simulations show that dredging to form a uniformly graded streambed and eliminate ponding in the upstream east arm of the ditch south of The Pines could lower the water table 0.2 to 2.0 feet in The Pines. Lowering the ditch stage in the Lakeshore by 0.5 to 1.0 foot would cause additional water-table decline of less than 0.5 foot in The Pines. Lowering the ditch stage both in the Lakeshore and in The Pines could lower the water-table in the Lakeshore by nearly 1.0 foot. (USGS) (USGS) W85-01948

FLOOD POTENTIAL OF FORTYMILE WASH AND ITS PRINCIPAL SOUTHWESTERN TRIB-UTARIES, NEVADA TEST SITE, SOUTHERN

NEVADA, Geological Survey, Carson City, NV. Water Resources Div. For primary bibliographic entry see Field 2E. W85-02037

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY,

FROM URBAN STREAMS IN LEON COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-sources Div. M. A. Franklin, and G. T. Losey. Available from OFSS, USGS, Box, 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 84-4004, 1984. 37 p, 10 Fig, 8 Tab, 31 Ref.

Descriptors: *Flood frequency, *Rainfall-runoff, *Unit hydrograph, Data collections, *Florida, Leon County, Urban areas.

Techniques are provided for estimating flood magnitudes for urban-flow streams in Leon County, Florida, for recurrence intervals of 2, 5, 10, 25, 50, Florida, for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years. Synthetic flood peaks were generated by using a calibrated lumped-parameter rainfall-runoff model, pan evaporation data from Milton, Florida, and long-term unit rainfall records from Thomasville-Collidge, Georgia, and Pensacola, Florida. The flood peaks were used in multiple linear regression analyses to derive regional equations relating flood magnitude to basin characteristics. Significant basin characteristics were drained area and impervious area. The average standard error of prediction ranged from + or - 32 percent for the 3-year recurrence interval to + or - 47 percent for the 500-year recurrence interval flood. (USGS)
W85-02047

FLOODS OF AUGUST 7-8, 1979, IN CHAUTAU-QUA COUNTY, NEW YORK, WITH HYDRAU-LIC ANALYSIS OF CANADAWAY CREEK IN THE VILLAGE OF FREDONIA, Geological Survey, Albany, NY. Water Resources

For primary bibliographic entry see Field 2E. W85-02051

EFFECIS OF SEDIMENTATION ON THE STORAGE CAPACITY OF THE HIGH ASWAN

DAM RESERVOIR,
Ministry of Irrigation, Cairo (Egypt). Research
Inst. of High Dam Side Effects.
S. Shalash.

Shalash.
 Hydrobiologia, Vol. 92, p 623-639, July, 1982. 12
 Fig, 14 Tab, 2 Ref.

Descriptors: *Nile River, *Egypt, *High Aswan Dam, Storage capacity, *Sedimentation, Dam ef-

fects, Suspended sediments, Flood discharge, Dead

The River Nile receives most of its sediment load from the Atbara and Blue Nile rivers, which carry eroded sediments north from the Ethiopian mountains during the seasonal flood between August and October. Prior to the construction and operation of the High Aswan Dam, in 1964, 9-10 x 10 to the 6th metric tons of suspended sediment were deposited annually in the flood plain of the Nile, while about 93% of the total average annual sus-pended load of 124 x 10 to the 6th metric tons was pended load of 124 x 10 to the 6th metric tons was carried out into the Mediterranean Sea. Since the full operation of the High Aswan Dam in 1968, the flood discharge of the Nile, below the dam, has been greatly modified and more than 98% of the total suspended load has been retained within the reservoir. Based on long-term records, estimated relationships between discharge and suspended load, and field measurements, the life span of the dead storage capacity has been estimated at a minimum of about 360 years. Although this preliminary calculation is less than the estimated design capacity of 450 years, it is expected that progressively more suspended solids will be released in the outflow of the reservoir and that together with the use of flood diversion schemes the High Aswan Dam is likely to approach its design life span. (Author's abstract) abstract) W85-02101

INVESTIGATION OF TWO POSSIBLE MODES

OF ACTION OF TWO POSSIBLE MODIES
OF ACTION OF THE INERT DYE AQUASHADE ON HYDRILLA,
University of South Florida, Tampa. Chemical and
Environmental Management Services Center.
D. C. Manker, and D. F. Martin.

Journal of Environmental Science and Health, Vol. A19, No. 6, p 725-733, 1984. 2 Fig, 1 Tab, 10

Descriptors: *Hydrilla, *Aquatic weed control, *Aquashade, Submersed plants, Plant growth, Shading, Photodynamic action.

The response of the submersed plant Hydrilla verticillata (Royle) in well water solutions of the inert ticulata (ROyle) in well water solutions of the mert dye Aquashade was measured. Growth rate was measured as increase in wet weight following two weeks in a phytotron room at 125 micro E/sq m/ sec. It was found that plants treated with 3 ppm Aquashade grew 30.8% +/- 9.9% compared to plants without Aquashade which grew 62.0% +/plants without Aquashade which grew 62.0% +/18%. The two mechanisms of action which were
investigated were shading and photodynamic
action. A plot of percent growth versus concentration of Aquashade showed exponential decrease
owing to shading. Available data indicate that the
effect of shading is the major, if not exclusive,
mode of action affecting the growth of hydrilla.

(Author's abstract) (Author's abstract)

WATER HYACINTH CANOPY AND PAN EVAPORATION,

Meteorological Office, Poona (India). L. S. Rathore, S. J. Maske, and S. K. Shaha Mausam, Vol. 35, No. 1, p 81-86, 1984. 5 Fig, 4 Tab, 3 Ref.

Descriptors: "Pan evaporation, "Water hyaciath, "Water loss, "Aquatic weeds, "Evaporation, "Evaportanspiration, "Vaporization, India, Climatic data, Weather patterns, Canopy, Air temperature, Transpiration control.

Using an open pan evaporimeter covered with water hyacinth, water loss was compared to a pan evaporimeter not covered by this aquatic weed. Meteorological parameters such as wind speed, rainfall, air temperature, water, temperature and canopy temperature were taken into consideration. The influence of water hyacinth canopy on water losses from free water surf-ces doubles the water losses from free water surrees doubles the water losses due to the plants higher transpiration rate. The application of a water budget to the canopy area provides the quantity of water vaporized from it during a particular budget period. These values of water loss will be helpful in water management,

Field 4-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control Of Water On The Surface

irrigation and other agricultural operations. (Wheatley-IVI) W85-02128

CASE FOR AUTOMATED WATER MANAGE-MENT,

For primar W85-02130 ary bibliographic entry see Field 6A.

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY, Office of Technology Assess DC.

ary bibliographic entry see Field 6A.

DESCRIPTIVE DECISION PROCESS MODEL FOR HIERARCHICAL MANAGEMENT OF INTERCONNECTED RESERVOIR SYSTEMS, Illinois Univ. at Urbana-Champaign. Dept. of Civil

Engineering.
R. I. Adiguzel, and O. Coskunoglu.
Water Resources Research, Vol. 20, No.7, p 803-811, July, 1984. 6 Fig. 3 Tab, 40 Ref, 1 Append.

Descriptors: *Model studies, *Multireservoir net-works, *Reservoir operation, Optimization, Deci-sion making, Planning, Multipurpose reservoirs.

A significant limitation of prescriptive optimization models is that their formulation is disassociated from the behavioral and organizational attributes of the problem addressed. In an attempt to alleviate this limitation a decision process model is formulated directly within a framework of decision agents involved in integrated long- and short-term planning and management of multipurpose and multireservoir system operations. The resulting model is hierarchical, multilevel, multilayer, and decentralized. As such it is descriptive of a reservoir system managed and operated by geographically separated multiple agents with different authorities and responsibilities. Robustness and performance of the model is investigated by using the Shasta-Trinity system of California as an example. Results are encouraging for the descriptive as well as prescriptive relevance of the model. (Author's abstract) W85-02147

4B. Groundwater Management

WATER-LEVEL CHANGES IN THE HIGH PLAINS REGIONAL AQUIFER, NORTHWEST-ERN OKLAHOMA, PREDEVELOPMENT TO

1980, Geological Survey, Oklahoma City, OK. Water

For primary bibliographic entry see Field 2F. W85-01771

WATER RESOURCES OF THE FORT UNION COAL REGION, EAST-CENTRAL MONTANA, Geological Survey, Helena, MT. Water Resources

For primary bibliographic entry see Field 2F. W85-01772

LP EMBEDDED SIMULATION MODEL FOR CONJUNCTIVE USE MANAGEMENT OPTI-MIZATION, Nevada Univ. System. Reno. Water Resources

C. R. Koltern

C. R. Aottermann.
Available from the National Technical Information
Services, Springfield, VA 22161 as PB84-202522,
Price codes: A07 in paper copy, A01 in microfiche.
Publication 41091, November 1983. 134 p, 31 Fig,
11 Tab, 50 Ref, 3 Append. Project No. OWRT A103-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Conjunctive use, *Linear program ming, *Simulation analysis, Management planning *Optimization, Groundwater management, Numer ical analysis, *Model studies.

Equations for groundwater flow and surface water continuity are embedded in a linear programming hydraulic management model for the optimal conjunctive use of a groundwater and surface water system. This management model uses groundwater and surface water variables directly as decision variables. Problem reduction methods by reduction of decision variables and reduction of constraints, is of little utility. Time was incorporated in a lumped transient formulation in which all time periods are executed at once and in a step-wise procedure in which final heads from current time step are used as initial heads in the next time step. procedure in which final heads from current time step are used as initial heads in the next time step. The hydraulic management approach is valid for the groundwater model, but appears too simplistic for the conjunctive use model. The embedding method is useful for small problems over a limited number of time steps, but encountered numerical difficulties when applied to a large real-world exoblem. problem. W85-01801

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN CHAMBERS, LIBERTY, AND MONTGOM-ERY COUNTIES, TEXAS, 1975-79, Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2F. W85-01818

RECORDS OF WELLS, DRILLERS' LOGS, WATER-LEVEL MEASUREMENTS, AND CHEMICAL ANALYSES OF GROUND WATER IN BRAZORIA, FORT BEND, AND WALLER COUNTIES, TEXAS, 1975-79, Geological Survey, Austin, TX. Water Resources Div.

For primary bibliographic entry see Field 2F. W85-01819

GROUND WATER IN THE REDDING BASIN, SHASTA AND TEHAMA COUNTIES, CALI-

FORNIA, Geological Survey, Menlo Park, CA. Water Resources Div. M. J. Pierce.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4052, 1983. 37 p, 7 Fig, 8 Tab. 23 Ref.

Descriptors: *Geohydrology, *Groundwater basins, *Groundwater level, Groundwater movebasins, *Groundwater level, Groundwater movement, Groundwater recharge, Groundwater storage, Water quality, *California, Redding Basin, Central Valley.

An appraisal of ground-water conditions in the Redding Basin was made by the U.S. Geological Survey and the California Department of Water Resources during 1979 and 1980. The basin covers Survey and the California Department of Water Resources during 1979 and 1980. The basin covers about 510 square miles in the northern part of the Central Valley of California. Ground water in the basin is obtained principally from wells tapping continental deposits of Tertiary and/or Quaternary age. These deposits are arranged in a synclinal structure that trends and plunges southward. Recharge to the basin is from subsurface inflow; infiltration of precipitation and excess irrigation water; and percolation of certain reaches of streams and creeks. Ground-water movement is generally from the periphery of the basin towards the Sacramento River. Hydrographs for the period 1956 to 1970 show only a slight water-level decline and virtually no change between 1970 and 1979. The total estimated pumpage for 1976 was 82,000 acre-feet. Estimated usable storage capacity for the basin is about 5.5 million acre-feet. Chemical quality of ground water is rated good to excellent. Water type is a magnesium-calcium bicarbonate in character. The underlying Chico Formation contains saline marine water which is of poor quality. (USGS) WESDIGES

APPRAISAL OF WATER FROM SURFICIAL-OUTWASH AQUIFERS IN TODD COUNTY

AND PARTS OF CASS AND MORRISON COUNTIES, CENTRAL MINNESOTA, Geological Survey, St. Paul, MN. Water Resources Div.

Sources Div.

C. F. Myette.

Available from OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225, USGS Water-Resources
Investigations Report, 1984. 43 p, 21 Fig, 8 Tab, 31

Ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, Water quality, Hydrologic models, Todd County, Morrison County, Cass County,

*Minnesota.

Outwash deposits consisting of medium to very coarse sand are an important aquifer in Todd County and in parts of Cass and Morrison Counties, Minnesota. The outwash ranges in thickness from 0 to 150 feet. Depth to water is generally less than 15 feet and annual water-level fluctuations are less than 5 feet. Aquifer-test results indicate that transmissivities range from 4,600 to 18,500 feet aquared per day and storage coefficients range from 0.10 to 0.25. Well yields of more than 2,000 gallons per minute can be obtained locally in properly constructed wells. The water is a calcium bicarbonate type and is generally suitable for most uses. The water is hard to very hard with dissolved-solids concentrations ranging from about 200 to 400 milligrams per liter. Pesticides are present in elevated concentrations but do not exceed U.S. Environmental Protection Agency recommended limits for domestic consumption. Results from numerical modeling experiments indicate that, with proper development, the groundwater system is capable of accommodating additional withdrawals. (USGS) W85-02038

AQUIFER TESTS IN THE STRATIFIED DRIFT, CHIPUXET RIVER BASIN, RHODE ISLAND, Geological Survey, Providence, RI. For primary bibliographic entry see Field 2F. W85-02039

HYDROGEOLOGY OF WELL-FIELD AREAS NEAR TAMPA, FLORIDA, PHASE 2-DEVEL-OPMENT AND DOCUMENTATION OF A QUASI-THREE-DIMENSIONAL FINITE-DIF-FERENCE MODEL FOR SIMULATION OF STEADY-STATE GROUND-WATER FLOW, Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 2F. W85-02052

COMPETITION VERSUS OPTIMAL CONTROL IN GROUNDWATER PUMPING WHEN DEMAND IS NONLINEAR,

New Mexico Univ., Albuquerque. Dept. of Mathematics and Statistics

R. C. Allen, and M. Gisser. Water Resources Research, Vol. 20, No. 7, p 752-756, July, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Water demand, *Groundwater management, *Water use, *Competition, *Optimal control, Pumping, Agriculture, Water rights.

Optimal control versus no control in groundwater pumping is considered under the assumption of a nonlinear demand function for water use. This study considers the case where many farmers and other users pump water from a common aquifer. Exclusiveness is present in the aquifer, since only farmers who own land overlying the aquifer can pump water, and other farmers are excluded from the resource. Cities and nonfarm producers own limited water rights, and can increase their water the resource. Cities and nonfarm producers own ilmited water rights, and can increase their water use only by purchasing water rights from other users. For the case of the nonlinear demand function, if water rights are properly defined and if the storage capacity of the aquifer is relatively large, the difference between a strategy of no control and a strategy of optimal control is small and thus can be ignored for practical policy considerations. Even if simulated optimal control yields slightly

WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

Watershed Protection—Group 4D

better results than no control, a strategy of no control is likely to yield better results than optimal control, unless one is sure that the estimated demand for groundwater is very close to the true ore-IVI)

4C. Effects On Water Of Man's Non-Water Activities

LAND USE, RUNOFF AND RECHARGE ON SELECTED WATERSHEDS IN THE U.S. VIRGIN ISLANDS, Caribbean Research Inst., St. Thomas, VI. H. Smith, and O. Ajayi. Technical Report No. 13, September 1983. 57 p, 10 Fig., 11 Tab, 33 Ref. Project No. OWRT A-012-VI(1), Contract/Grant No. 14-34-0001-2150.

Descriptors: *Land use, *Surface runoff, *Rainfall-runoff relationships, Groundwater recharge, *Nat-ural recharge, Land management, Land develop-ment, Surface-groundwater relationships, *Water-sheds, *Virgin Islands, *St Thomas, West Indies.

Three watersheds with different land use characteristics on St. Thomas, Virgin Islands were instrumented and monitored to study the effects of various land use patterns on runoff and groundwater recharge. The water crop (combined runoff and groundwater recharge) for each watershed was calculated using two different methods, and the runoff determined independently using a Soil Conservation Service method. While results illustrated the effect of different land uses on recharge, the wide discrepancies in results according to the method applied highlighted the need for extensive data collection for such a study to be conclusive. W85-01799

GROUND-WATER HYDROLOGY AND QUALITY BEFORE AND AFTER STRIP MINING OF A SMALL WATERSHED IN JEFFERSON

A SMALL WATERSHED IN SERVERMON, OHIO, Geological Survey, Columbus, OH. Water Resources Div.

A. C. Razem. OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4215, 1984. 39 p, 18 Fig. 5 Tab, 12 Ref.

Descriptors: Coal, *Groundwater, *Strip mines, Sedimentary rocks, Perched water, Observation wells, Spoil banks, *Base flow, *Ohio, Jefferson

County.

Ground-water conditions before and after surface mining of a small watershed are described as part of a study to determine the effects of mining on hydrologic systems. The watershed was underlain by stratified sedimentary rocks containing local aquifers above shaley clay beds associated with the major coal seams. Mining involved removing the overburden rocks, including most of the top aquifer, stripping the coal, and recontouring the overburden spoils to the approximate premining shape of the watershed. Replacement of the top aquifer by spoils during regrading has caused many changes in recharge and discharge rates, saturated thickness, aquifer characteristics, and water quality. In the middle aquifer there were changes in saturated thickness and water quality. Resaturation of the top-aquifer spoils during and after reclamation has been slow. Saturated thicknesses have ranged from zero initially after mining to 4 feet after 1 1/2 years. Water levels in the middle aquifer have risen from a few feet to 40 feet. Water quality generally has been degraded: concentrations of bicarbonate, calcium, magnesium, chloride, iron, manganese, sulfate, and dissolved soils have increased. Premining water types remained about the same after mining, except for some changes from bicarbonate type to sulfate type. (USGS) W85-01943

FLOOD-FREQUENCY ESTIMATES FOR FIVE GAGED BASINS IN WICHITA, KANSAS,

Geological Survey, Lawrence, KS. Water Resources Div. For primary bibliographic entry see Field 2A. W85-01949

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MON-TANA

Geological Survey, Helena, MT. Water Resources For primary bibliographic entry see Field 5B. W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HAS-KELL COUNTY, OKLAHOMA, Geological Survey, Oklahoma City, OK. Water Resources Div. For primary bibliographic entry see Field 5B. W85-02041

MAGNITUDE AND FREQUENCY OF FLOODS FROM URBAN STREAMS IN LEON COUNTY,

FLORIDA, Geological Survey, Tallahassee, FL. Water Resources Div. For primary bibliographic entry see Field 4A. W85-02047

SEDIMENT CONCENTRATIONS FROM IN-TENSIVELY PREPARED WETLAND SITES, Clemson Univ., SC. Belle W. Baruch Forest Science Inst.

ence Inst. G. R. Askew, and T. M. Williams. Southern Journal of Applied Forestry, Vol. 8, No. 3, p 152-157, August, 1984. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Sedimentation, *Logging, *Drainage systems, *Bay lands, *South Carolina, *Suspended sediments, Erosion, Roads, Drainage ditches, Construction Wetlands, Water pollution sources, Water pollution control.

Water pollution control.

Conversion of pocosin and bay lands in the south-eastern US from natural hardwood stands to loblolly pine plantations usually involves the installation of some form of drainage system followed by
logging, site preparation, and planting. The drainage system may provide a pathway for sediment
produced by these activities to reach natural
streams. Suspended sediment concentrations were
measured in water draining from a 5,900-acre
carolina bay located in southeastern Georgetown
County, South Carolina, which is undergoing conversion to loblolly pine plantations. Samples were
collected during the first storm-flow event of each
month between January 1981 and December 1982
from subwatersheds involved in some of several
phases of conversion. Suspended sediment concentrations in water draining from the bay averaged
16 mg/l despite logging, site preparation road
maintenance and use, and installation of drainage
ditches. Road erosion and ditch installation produced the highest suspended sediment concentrations. ditches. Road erosion and ditch installation produced the highest suspended sediment concentrations. Suspended sediment concentrations. Suspended sediment concentrations decreased substantially with increasing distance from the sediment source. Logging and site preparation did not lead to increased sedimentation as long as heavy equipment was not allowed to operate in the ditches. Apparently on the flat coastal soils overload flow normally transports sediment only from roads or from disturbed sites immediately adjacent to drainage ditches. One way to minimize the impact of roads and new drainage ditches is to use a drainage system that contains a length of main channel between sediment sources and sensitive areas. (Moore-IVI)

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Re-

ary bibliographic entry see Field 5B.

4D. Watershed Protection

SEDIMENT TRANSPORT IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA, 1980-81, Geological Survey, Anchorage, AK. Water Re-sources Div.

For primary bibliographic entry see Field 2J. W85-01788

EROSION CONTROL AT HIGH ALTITUDES (EROSIONSBEKAMPFUNG IM HOCHGE-BIRGE

Buero fuer Landschaftsplanung, Uster (Switzer-T. Weibel.

Wasser, Energie, Luft, Vol. 76, No. 3/4, p 62-63, 1984. 3 Fig.

Descriptors: *Erosion control, *High altitude, *Vegetation, *Austria, Trees, Forests, Stream erosion, Stream banks, Bank stabilization, Floods.

sion, Stream banks, Bank stabilization, Floods.

Biological means of erosion control in the Austrian high Alps were the subject of the Biological Engineering Association's fourth annual conference, held in Brixen, Austria. Emphasis was placed on steep slopes and on running water. In the South Tyrol, spruce, larch, and Scotch fir offer maximum erosion protection. The difficulty of finding suitable species and the seeds thereof for planting in eroded areas (in order to stabilize them) at the edge of forests at altitudes of 2,500 m produced less than satisfactory results. Zanggenbach is a stream whose bed was anchored with barriers 10 yr ago. Lack of bank reinforcement has resulted in the stream scouring into its banks between the barriers. Since 1980, its flow profile has been undergoing restoration and is being secured by plantings on the banks; stone blocks at the foot of the planting sites prevent the stream from undermining them. There is a head of 3 m between stream barriers, which is the maximum for biological bank stabilization. Proof of success of the plantings was seen when they withstood tractive stresses of 12 and 22 kg/sq m 6 and 15 mo after planting during the floods of October 1980 and July 1981. The limited success of measures at Piz Culac, 1,900–1,100 m above sea level where forests were planted to secure eroded areas was attributed to the use of unsuitable species. (Gish-IVI)

ENSURING A HIGH LEVEL OF EFFECTIVE-NESS AND INTENSITY OF AGRICULTURAL AND WATER-MANAGEMENT PRODUCTION IN DRINKING-WATER CATCHMENT AREAS (SICHERUNG HOHER EFFEKTIVITAT UND INTENSITAT DER LANDWIRTSCHAFTLI-CHEN UND WASSERVIRTSCHAFTLICHEN PRODUKTION IN TRINKWASSER-EINZUGS-

GEBIETEN), Technische Univ., Dresden (German D.R.). Ber-

eich Hydrobiologie. S. Dyck, U. Grunewald, and D. Uhlmann. Wasserwirtschaft-Wassertechnik, Vol. 34, No. 3, p 56-58, April, 1984. 2 Fig. 14 Ref.

Descriptors: *Watershed protection, *Agriculture, *East Germany, Catchment areas, Drinking water, Water management, Land use, Cycling nutrients, Hydrologic models.

Rational use and effective protection of natural resources are vital components of the German Democratic Republic's economic strategy for the 1980s. Since the ground acts as a reservoir for nutrients and water, the implementation of these goals with regard to drinking water is largely dependent on integrating the interests of intense agricultural production and those of water management in drinking-water catchment areas (comprising about 14% of the country's agricultural land). Interdisciplinary research is being conducted in drinking-water reservoir catchment areas in the Tzz mountains with the aim of developing general principles for planned, scientifically-based multiple land use in all catchment areas in the hard-rock region. The studies will also objectify and revise existing restrictions on agricultural land use, cattle Rational use and effective protection of natural

Group 4D—Watershed Protection

farming, and communal land use. Especially signif-icant is the development of methods of analyzing interrelationships between land, plants, and animals determined by natural cycles (e.g., nitrogen, phos-phorus, agricultural, or water cycles) and their effect on water resources. Such complex analysis also places new demands on intradisciplinary re-search: e.g., the old block model of hydrological processes is no longer adequate and is replaced by continuous process analysis of separate flow com-ponents. (Grish-IVI)

SEDIMENT TRANSPORT IN THE LOWER YAMPA RIVER, NORTHWESTERN COLORA-

DO, Geological Survey, Lakewood, CO. Water Re-For primary bibliographic entry see Field 2J. W85-02045

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

PRELIMINARY FINDINGS OF THE PRIORI-TY POLLUTANT MONITORING PROJECT OF THE NATIONWIDE URBAN RUNOFF PRO-GRAM.

Dalton-Dalton-Newport, Inc., Cleveland, OH. R. H. Cole, R. E. Frederick, R. P. Healy, and R.

Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 898-908, July 1984. 1 Fig. 7 Tab,

Descriptors: *Monitoring, *Pollutant identifica-tion, *Organic compounds, *Urban runoff, *Metals, Pentachlorophenol, Copper, Lead, Zinc, Cadmium, Path of pollutants.

Twenty-four pollutants were detected in at least 10% of the urban runoff samples. These were selected for further evaluation and consideration of 10% of the urban runoff samples. These were selected for further evaluation and consideration of their implications in water quality protection and maintenance. The organic priority pollutants found most frequently in the predominantly residential and commercial area samples pose little risk to humans at detected levels. The predominant pathway for human exposure to the organics associated with gasoline is through ingested food and inhalation, so that contaminated surace water should pose little risk at the levels measured in Nationwide Urban Runoff Program (NURP) samples. Some of the priority pollutant metals in urban runoff could represent a potential risk to human health. The noncarcinogenic human health criteria, drinking water standards, and human carcinogenic criteria were exceeded. Nickel concentrations in undiluted runoff exceeded the human health criterion of 13.4 micro g/liter in 30% of the samples. Arsenic concentrations in undiluted runoff frequently exceeded the EPA human carcinogenic criterion. Because most storms last between 2 and 16 hours, the most meaningful measure of potential aquatic life effects is a comparison of pollutant concentrations with acute water quality criteria and toxicity values. If pollutant levels exceed these values before dilution, then aquatic species are likely to be impacted in the mixing zone. Pentachorophenol was the only organic priority pollutant to exceed freshwater acute aquatic life criteria. Four priority pollutant metals, Cd, Cu, Pb, and Zn, exceeded freshwater acute aquatic life criteria in 9 to 50% of the samples. (Baker-IVI)

DETERMINATION OF ORGANOHALOGENIC ACIDS IN WATER SAMPLES (BESTIMMUNG HALOGENORGANISCHER SAUREN IN WAS-SERPROBEN),

SEMPROBEN, Bremen Univ. (Germany, F.R.). Fachbereich Chemie/Biologie. U. Lahl, B. Stachel, W. Schroer, and B. Zeschmar. Zeitschrift für Wasser und Abwasser Forschung, Vol. 17, No. 2, p 45-49, 1984. 7 Fig. 5 Tabs, 5 Ref.

Descriptors: *Halogenated hydrocarbons, *Trichloroacetic acid, *Chlorination, Chemical analysis, Hypochlorite, Humic acids, Lignin sulfonic acids, Bromine, Drinking water, Swimming pools, Tribromacetic acid, Surface water.

A method for the determination of halogenorganic A method for the determination of halogenorganic acids in water samples is presented. As the results of the analyses show, trichloroacetic acid (TCA) seems to be a by-product of drinking water chloriantion. Laboratory experiments show, that TCA is generated by reaction of hypochlorite with humic and ligninsulfonic acids. Furthermore in the presence of comparatively high bromide concentrations the generation of tribromoacetic acid (TBrA) could be seen. Analytical results of different drinking, surface and swimming pool water samples are presented. Mean concentrations of 36 micro g/l TCA were found in the water of several public swimming pools. (Author's abstract) W85-01663

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),

Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie. For primary bibliographic entry see Field 5F. W85-01664

DETERMINATION OF 2,3,7,8-TETRACHLOR-ODIBENZO-P-DIOXIN WASTEWATER,

Dow Chemical Co., Midland, MI. Analytical Labs. T. L. Peters, T. J. Nestrick, and L. I. Lamparski. Water Research, Vol. 18, No. 8, p 1021-1024, 1984. 2 Fig. 1 Tab, 4 Ref.

Descriptors: *TCDD, *Wastewater analysis, Dioxins, Gas chromatography, Mass spectrometry.

The EPA recently proposed a procedure designated as Method 613 for the determination of parts-per-trillion concentrations of 2,3,7,8-tetrachlorodi-benzo-p-dioxin (TCDD) in wastewater effluents. Interference problems encountered while attempting to utilize this procedure led to modifications which shorten the analysis time, simplify the procedure and improve the recoveries. A combination of cleanup steps on silica, alumina, and reactant modified adsorbents yields a relatively interference-free residue when examined by gas chromatography/mass spectrometry in the selected ion monitor (SIM) mode of operation. (Moore-IVI)

DETERMINATION OF OXIDANTS FORMED UPON THE DISINFECTION OF DRINKING WATER WITH CHLORINE DIOXIDE,

Louisiana State Univ., Baton Rouge. Inst. for En-

Loussana State Only, Baton Rouge, Inst. for Environmental Studies.

B. Limoni, E. Choshen, and Ch. Rav-Acha.
Journal of Environmental Science and Health,
Vol. Al9, No. 8, p 943-957, December, 1984. 3
Fig. 3 Tab, 17 Ref.

Descriptors: *Disinfection, *Drinking water, *Oxidants, *Chlorine dioxide, *Israel, Chlorine, Chlorate, Chlorite, Water treatment, Halogenated hy-

The disinfection policy of the National Water Carrier of Israel has recently been changed from chlorine to chlorine dioxide. The need for a precise determination of ClO2 and all its inorganic byproducts has been recognized. A careful study of the analytical methods needed for such precise determinations leads to the conclusion that combined methods should be applied simultaneously. While the specific chlorine electrode method could satisfactorily determine the concentrations of Cl2 satisfactorily determine the concentrations of Cl2 and ClO2 together at pH 7, the chlorophenol red method was needed for the specific determination of ClO2. The chlorite was determined by the specific chlorine electrode at pH 2, and a good corre-lation was found with the polarographic method which is specific for chloride. The small concen-trations of chlorine produced upon disinfection with ClO2 can explain the few chloro-organic

materials that were formed. It seems that the chlorine which is produced during disinfection with ClO2 reacts further with some of the organic materials found in the water to produce halogenated organic compounds. (Baker-IVI) W85-01743

DETERMINATION OF 4-AMINOPHENOL IN WATER BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH FLUORES-CENCE DETECTION,

State Chemical Supervision Service, Soeborg (Denmark).
B. Schultz.

Journal of Chromatography, Vol. 299, No. 2, p 484-486, September, 1984. 2 Fig, 8 Ref.

Descriptors: *Water analysis, *Phenols, *Chromatography, *Pollutant identification, *Insecticide, Parathion, Water quality control.

The determination of 4-aminophenol, a metabolite of the insecticide parathion, in water is described using ion pair HPLC and fluorescence detection. Maximum excitation and emission wavelengths for 4-aminophenol were 323 and 373 nm, respectively. Maximum excitation and emission wavelengths for 4-aminophenol were 323 and 373 nm, respectively. Phenol has excitation and emission maxima at 276 and 298 nm, respectively. The detection limit using fuorescence detection of 4-aminophenol was 330 pg. Injection of 100 micro I water sample then gives a detection limit for 4-aminophenol in water corresponding to 3 micro g/l, or 3 ppb. The analysis of tap water and surface water did not show any interference, giving the same detection limit in these media as in Milipore-filter water. Regression analysis showed a linear correlation between the injected amount and the fluorescence intensity for 4-aminophenol in the range 0.3-3 ng. A relative standard deviation of 0.4% was obtained for direct determination of 4-aminophenol at a concentration of 5 micro g/l in tap water. (Baker-IVI)

QUANTITATIVE DETERMINATION OF PPB LEVELS OF CARBAMATE PESTICIDE IN WATER BY CAPILLARY GAS CHROMATOG-

WATER BY CAPILLARY GAS CHROMATOG-RAPHY, New York State Coll. of Human Ecology, Ithaca. Dept. of Design and Environmental Analysis. W. Z. Zhong, A. T. Lemley, and J. Spalik. Journal of Chromatography, Vol. 299, No. 1, p 269-274, September, 1984. 2 Fig. 2 Tab, 9 Ref. EPA grant R809867.

Descriptors: *Water analysis, *Pesticides, *Carba-mates, *Aldicarb, *Chromatography, Water qual-ity control, Drinking water, Wells, Surface waters.

A new gas chromatographic method is reported for the quantification of aldicarb and its oxidative metabolites. The method has also been modified for quantification of carbofuran, oxamyl and methomyl. An open tubular column and a nitrogen phosphorus detector are used to quantify nanogram levels of aldicarb, aldicarb sulfoxide and aldicarb sulf gram levels of aldicarb, aldicarb sulfoxide and aldicarb sulfone in a one injection procedure. Linear calibration curves are obtained for each species. The method is particularly useful for environmental sampling and for degradative studies in soil-water systems in the laboratory since all three metabolites can be determined in one sample. A typical chromatogram of a mixture contaning 2 micro g/ml each of aldicarb, aldicarb sulfoxide and aldicarb sulfone is shown. By comparing peak areas obtained from injections of the individual compounds to those obtained from the mixture, it is shown that there is no evidence of oxidation of the aldicarb or aldicarb sulfoxide to the next metabolite under the experimental conditions described. The amount recovered by the extraction procedure bolite under the experimental conditions described. The amount recovered by the extraction procedure for each metabolite in four standard aqueous solutions in both distilled water and well water ranging in concentration from 5 to 20 ppb was 96 to 105%. The high recoveries of aldicarb can only be achieved with slow evaporation of the solvent extract at a temperature less than 40 C. The extraction procedure permits analysis of water samples with concentrations of aldicarb and its metabolites as low as 1 ppb. (Baker-IVI)

Identification Of Pollutants-Group 5A

DETERMINATION OF ALDICARB AND ITS DERIVATIVES IN GROUNDWATERS BY HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH UV DETECTION,

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences. C. J. Miles, and J. J. Delfino. Journal of Chromatography, Vol. 299, No.1, p 275-280, September, 1984. 2 Fig. 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Aldicarb, *Pesticides, *Chromatography, Water quality control, Pollutant identification.

The method presented allows rapid and precise determination of aldicarb and several of its derivadetermination of aldicarb and several of its deriva-tives in groundwater down to the micro g/l or nanogram level without sample pretreatment. UV spectra of aldicarb and its derivatives showed the maximum absorption wavelengths to range from 197 to 203 nm with the exception of aldicarb sulfone nitrile. A chromatogram of four aldicarb derivatives separated isocratically with a mobile phase of acetonitrile-water on a Zorbaxoctyl sta-tionary phase is shown. Standard curves for the compounds tested were linear over the range excompounds tested were linear over the range ex-amined and squares of the correlation coefficients for four-point standard curves were very good. Limits of detection for the three carbamyl oximes and their oximes were approximately 10 micro g/l or 2 ng each. Detection of aldicarb sulfone nitrile or 2 ng each. Detection of aldicarb sulfone nitrile can be vastly improved by decreasing the wave-length of detection, however, increased absorption of interferences and mobile phase limit the useful-ness of this modification. Reversed-phase HPLC with UV detection proved a useful method for the rapid determination of aldicarb and its derivatives in aqueous samples down to the micro g/l or nanogram level. Two isocratic runs were used to separate all the aldicarb compounds in a reasonable time, although solvent programming could deexpanse au the addicarb compounds in a reasonable time, although solvent programming could de-crease total analysis time. No sample pretreatment was needed which allowed rapid and precise meas-urements of degradation of aldicarb, aldicarb sulf-oxide, and aldicarb sulfone in groundwater micro-cosms. (Baker-IVI) cosms. (Baker-IVI) W85-01748

HEAVY METALS IN ULVA LACTUCA COL-LECTED WITHIN TOLO HARBOUR, AN ALMOST LANDLOCKED SEA, Chinese Univ. of Hong Kong, Shatin. Dept. of

For primary bibliographic entry see Field 5B. W85-01762

EFFECTS OF PHOSPHATE FERTILIZER AP-PLICATIONS AND CHEMISTRY-MINERALO-GY OF THE IRON OXIDE SYSTEM ON PHOS-PHATE ADSORPTION-DESORPTION BY STREAM SEDIMENTS, Ohio State Univ., Columbus. Dept. of Agronomy. For primary bibliographic entry see Field 5B. W85-01794

METAL SPECIATION IN SURFACE WATERS OF THE GREAT LAKES REGION,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

eries and Wildlife.
J. P. Giesy.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-190396,
Price codes: A04 in paper copy, A01 in microfiche.
Institute of Water Research Completion Report,
September 1983. 60 p, 9 Fig, 5 Tab, 130 Ref.
Project No. OWRT A-121-MICH(1), Contract/
Grant No. 14-34-0001-2124.

Descriptors: *Uranium, *Trace metals, Computer model, Ion exchange, Chemical reactions, Dynamics, Humic acids, Chemical analyses, *Stability constants, Model studies, Thermodynamics, Laser fluorometry, Scatchard analyses, Gaussian model, Psediction.

Predicting the dynamics of trace metals such as uranium by thermodynamic prediction models is contingent upon accurate stability constants. Conditional stability constants (K') for the binding of uranyl ion (UO2(2+)) to humic substances were

determined by both Scatchard analyses and by fitting the data to a Gaussian model of multiple sites. UO2(2+) was separated from that which was bound to humic material by ion exchange. Uranium concentration was measured by laser fluorometry. There is a broad range of strengths of sites such that K' was dependent on the UO2(2+) humic ratio. The maximum binding capacity of the humic material was 4.83 x 10 to the minus 4th power M/g. The log K' determined for log metal/jigand ratios of 1.5 to -0.5, the ecologically significant range of interest for UO2(2+), which was from 10 - 50 micrograms/l at the carbon concentration of 2.36 mg/l used in this study, was determined by Scatchard analysis to be 7.38. The estimate based on a Gaussian distribution was 6.85.

FLUORIDE, NITRATE, AND DISSOLVED-SOLIDS CONCENTRATIONS IN GROUND WATERS OF WASHINGTON, Geological Survey, Tacoma, WA. Water Re-sources Div.

For primary bibliographic entry see Field 2F. W85-01828

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND BY OIL AND PCB INCESTION, Lawrence Livermore National Lab., CA.
R. B. Spies, J. S. Felton, and L. Dillard. Marine Biology, Vol. 70, No. 2, p 117-127, September, 1982. 6 Fig. 5 Tab, 45 Ref. DOE contract W-7405-Eng-48 and EPA contract EPA-1AG-D6-E681-CF.

Descriptors: *Oil pollution, *Polychlorinated biphenyls, *Flatfish, *California, *Monitoring, *Mixed-function oxidases, Water pollution effect, Coastal areas, Enzymes, Effluents, Fish, Adapta-

Hepatic mixed-function oxidases (MFOs) were measured in the bothid flatfishes Citharicthys sordidus and C. stigmaeus from relatively uncontaminated and from polluted coastal populations of California, USA, at various times of the year during 1979-1980 and in individuals fed crude oil and polychlorinated biphenyl-augmented food in the laboratory. For C. sordidus, aryl hydrocarbon hydrocylase (AHH) specific activity was generally highest around the Los Angeles County sewage outfall on the Palos Verdes Shelf, intermediate near the 7-mile Hyperion sewage outfall in Santa Monica Bay and around a petroleum seep in the Santa Barbara Channel, the lowest in relatively unpolluted Monterey Bay. For C. stigmaeus, which had about ten times less specific activity than the foregoing species, specimens from the Santa Barbara petroleum seep had significantly greater AHH specific activity than those from Monterey Bay. Fishes from contaminated environments also showed increases of microsomal proteins with molecular weights of 56, 54, 57, and 46 x 10 to the 3rd; moreover, the content of cytochrome P-450 was elevated in specimens of C. sordidus from such environments. Augmentation of food with seep oil or polychlorinated biphenyls (PCBs) induced significant increases in the specific activity of AHH and amounts of microsomal proteins in C. stigmaeus. Thus, these two species of flatfishes are good candidates for monitoring biologically meaningful levels of petroleum and polychlorinated biphenyls in contaminated environments. Moreover, the mixed function oxidase pattern in fish populations from the Santa Barbara petroleum seep is evidently a functional adaption to chronic intake of petroleum hydrocarbons. (Author's abstract) thor's abstract) W85-01894

MYTILUS GALLOPROVINCIALIS AND PARA-PENAEUS LONGIROSTRIS AS BIOINDICA-TORS OF HEAVY METAL AND ORGANOCH-

LORINE POLLUTION, Institute of Oceanographic and Fisheries Research,

Institute of Greatographic and Asthems (Greece).

J. Satsmadjis, and F. Voutsinou-Taliadouri.
Marine Biology, Vol. 76, No. 2, p 115-124, November, 1983. 1 Fig. 6 Tab, 31 Ref.

Descriptors: "Bioindicators, "Mussels, "Shrimp, "Heavy metals, "Chlorinated hydrocarbons, "Saronikos Gulf, "Greece, Seasonal variation, Sampling, Marine environment.

pling, Marine environment.

The mussel Mytilus galloprovincialis and the shrimp Parapanaeus longirostris were evaluated as bioindicators for pollution by heavy metals (Fe, Za, Cu, Pb, Mn, Ni, Cd, Cr, Co) and chlorinated hydrocarbons (PCBs, p.p*DDE, p.p*DDT, p.p*DDD, BHCs, heptachlor epoxide, dieldrin, endrin). The accuracy of the determinations, the spot and area variability, the overall coefficient of variation, the effect of the season and the size, the differences observed in four sections of the Saroni-kos Gulf (Greece) for P. longirostris, and the degree of pollution, which was estimated independently by measuring the concentration in the water of nutrients and dissolved oxygen. The organisms can be used as bioindicators of pollution. The individual variability of response, the season and the size do not cause as much assessment error as the large temporal fluctuations and the frequent inadequacies of the analytical procedures. A truly representative sample can be collected by selecting a definite specimen size range, and collecting the organisms over a three month period in an area of uniform salinity and at the same depth. (Moore-IVI)

W85-01899

SPATIAL AND TEMPORAL TRENDS IN HEAVY METAL CONCENTRATIONS IN MUS-SELS FROM NORTHERN IRELAND COAST-

AL WATER, Queen's Univ., Belfast (Northern Ireland). Dept. of Agricultural and Food Chemistry.
N. F. S. Gault, E. L. C. Tolland, and J. G. Parker. Marine Biology, Vol. 77, No. 3, p 307-316, December, 1983. 8 Fig. 7 Tab, 29 Ref.

Descriptors: *Bioindicators, *Heavy metals, *Mussels, *Northern Ireland, Coastal waters, Spatial distribution, Temporal distribution, Mercury, Chromium, Water pollution effects, Marine envi-

Data are presented on the heavy metal concentrations in mussels, Mytilus edulis (L), sampled over a 1 yr period (August 1980-August 1981) from Northern Ireland coastal waters. The study was aimed at investigating the spatial extent and temporal trends in heavy metal contamination and highighting any areas with exceptionally high levels of toxic metals. With the exception of two sites with high values for mercury and chromium, respectively, contamination by metals was relatively low. Significant spatial and temporal differences in the concentrations of several metals were found. There were also significant spatial x temporal interactions for all metals studied. Significant negative correlations between the percentage dry matter content of for all metals studied. Significant negative correla-tions between the percentage dry matter content of mussels and the concentrations of several metals were found. There were also significant positive correlations between certain pairs of metals. It is proposed that small variations in contamination of the marine environment can be detected by subtle differences in the concentration of metals in mus-sels and that mussel condition may be adversely affected by metal contamination. (Author's ab-stract) W85-01901

BIOAVAILABILITY OF PB AND ZN FROM MINE TAILINGS AS INDICATED BY ERYTH-ROCYTE DELTA-AMINOLEVULINIC ACID DEHYDRATASE (ALA-D) ACTIVITY IN SUCK-ERS (PISCES: CATOSTOMIDAE),

Columbia National Fisheries Research Lab., MO. C. J. Schmitt, F. J. Dwyer, and S. E. Finger. Canadian Journal of Fisheries and Aquatic Science, Vol. 41, No. 7, p 1030-1040, 1984. 3 Fig. 4 Tab, 38 Ref.

Descriptors: *Suckers, *Enzymes, *Lead, *Zinc, *Bioavailability, *Mine wastes, Heavy metals, Cadmium, Bioassay, Blood, Statistical models, Fish.

The activity of the erythrocyte enzyme delta-amin-olevulinic acid dehydratase (ALA-D) was meas-

Group 5A-Identification Of Pollutants

ured in 35 catostomids (black redhorse, Moxostoma duquesnei; golden redhorse, M. erythrurum; northern hogsucker, Hypentelium nigricans) collected from three sites on a stream contaminated with Pb., Cd., and Zn-rich mine tailings and from an uncontaminated site upstream. Enzyme activity was expressed in terms of hemoglobin (Hb), DNA, and protein concentrations; these variables can be determined in the laboratory on once-frozen blood samples. Concentrations of Pb and Zn in blood and of Pb in edible tissues were significantly higher, and ALA-D activity was 62, and ALA-D activity was 62, 67% lower than upstream. Lead concentrations in most contaminated site, ALA-D activity was 62-67% lower than upstream. Lead concentrations in the edible tissues and in blood were positively correlated (r = 0.80), whereas ALA-D activity was negatively correlated with Po in blood (r = 0.70) and in edible tissues (r = 0.59). Five statistically significant relations between Pb and Zn in blood and ALA-D activity were determined. The two models that explained the highest percentage (> 74%) of the total variance also included factors related to Hb concentration. All five significant models included negative coefficients for variables that represented Pb in blood and positive coefficients for Zn in blood. The ALA-D assay with results standarized to Hb concentration represents cients for Zn in blood. The ALA-D assay with results standarized to Hb concentration represents an expedient alternative to the more traditional hematocrit standardization, and the measurement of ALA-D activity by this method can be used to document exposure of fish to environmental Pb. (Author's abstract) W85-01918

ESTIMATES OF DISSOLVED AND SUSPEND-ED SUBSTANCE YIELD OF STREAM BASINS IN MICHIGAN,

Geological Survey, Lansing, MI. Water Resources Div.

USGS Water-Resources Investigations Report 83-4288, 1984. 57 p, 4 Fig, 5 Tab, 2 Ref.

Descriptors: *Water quality, *River basins, Streams, *Hydrologic data networks, *Regression analysis, Yield equations, *Great Lakes, *Michi-

Water-quality data collected at 20 stations in Michigan were used to develop regression equations relating discharge to loads of 19 dissolved and suspended substances measured at each station. These equations and mean daily discharge were used to estimate long-term loads, which then were converted to estimates of drainage basin yields. These yields were compared to measured yields and to previous estimates. Fifty percent of the equations had standard errors of 22 percent or less, 90 percent had standard errors of 80 percent or less. Regression exponents indicate that the load increases as discharge increases in all cases, but for less. Regression exponents indicate that the load increases and discharge increases in all cases, but for about two-thirds of the substances or properties the increase is less rapid than that of discharge. Seventy-eight percent of the nitrogen, phosphorus, and sediment loads, taken as a group, increase more rapidly than discharge. With respect to concentration, about 63 percent of the substances or properties decrease as discharge increases. W85-01942

PESTICIDE AND PCB LEVELS IN FISH FROM ALBERTA (CANADA). Alberta Environmental Centre, Vegreville. Chemosphere, Vol. 13, No. 1, p 19-32, 1984. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Alberta, *Pesticides, *Fish, *Polychlorinated biphenyls, Organic compounds, Path of pollutants.

Concentrations of 43 pesticides and PCB's were determined in muscle and fat samples of 750 fish collected from 11 lakes and rivers in Alberta. Of the 43 compounds tested for, evidence was found for only 12. Although phenoxy and organophosphate residues were always below detectable limits, traces of chlorinated pesticides and their derivatives, particularly DDE, DDD and chlor-dane, were detected in most fat samples. Methoxychlor was frequently found in goldeye from the

North Saskatchewan River but not recorded in fish from any other lake or river. Its presence in goldeye, a highly migratory species, was probably a result of bitting-fly control programs in the Saskatchewan part of the river. PCB levels exceeded 25 mg/kg in the fat of several species from the North Saskatchewan River but were generally lower in the other systems. Analysis of 160 sediment samples from the North Saskatchewan River revealed no point source of PCB contamination, with residues always less than 0.01 mg/kg dry weight. As a result, residues in the muscle tissue of fish were also relatively low compared to other industrialized areas. (Baker-IVI) W85-01954

IDENTIFICATION OF NONIONIC DETERGENTS BY GC/CI-MS: I. A COMPLEMENTARY METHOD OR AN ATTRACTIVE ALTERNATIVE TO GC/EI-MS AND OTHER METH-ODS, Stanford Univ., CA. Dept. of Civil Engineering.

E. Stephanou. Chemosphere, Vol. 13, No. 1, p 43-51, 1984. 8 Fig, 2 Tab, 19 Ref. National Science Foundation Grant No. CEE-81-1756.

Descriptors:
*Pollutant identification,
*Wastewater analysis, *Organic compounds,
*Chemical ionization mass spectra, *Detergents,
Alkylphenol ethoxylates, Alcohol ethoxylates

Chemical ionization (CI) mass spectra was used to identify tertiary octylphenol and lauryl alcohol ethoxylates with one to six oxyethylene groups in the effluent from the primary clarifiers of a Palo Alto wastewater treatment plant. This plant provides secondary treatment with trickling filters and activated sludge processes in series, and filtration prior to effluent chlorination. In lab studies technical grade tertiary octylphenol ethoxylates and lauryl alcohol ethoxylates were dissolved in methylene chloride to give a concentration of 1.5-2 mg/ml. Both products are nonionic detergents with an naury acconol etnoxylates were dissolved in methylene chloride to give a concentration of 1.52 mg/ml. Both products are nonionic detergents with an average number of oxyethylene groups of 5-6. The methane CI induced mass spectra of the tertiary octylphenol ethoxylates gives very reliable information on the molecular weight of the compounds because of the presence of the adduct ions (MH)+and (MC2H5)+. These ions are subsequently fragmented to the ions (MH-112)+ and (MC2H5-112)+ (olefin displacement), which allows determination of the length of the oxyethylene chain. The alkyl ion displacement gives information about the alkyl substituent of the phenolic ring. The mass chromatograms show that a selective detection of these surfactants, using their CI mass spectra, is very appropriate for routine procedures. (Baker-IVI)

AQUATIC LEECHES (HIRUDINEA) AS BIOIN-DICATORS OF ORGANIC CHEMICAL CON-TAMINANTS IN FRESHWATER ECOSYS-

TEMS, Canada Centre for Inland Waters, Burlington (On-

J. L. Metcalf, M. E. Fox, and J. H. Carey. Chemosphere, Vol. 13, No. 1, p 143-150, 1984. 3 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Bioindicators, *Leeches, *Ganagagigue Creek, Ontario, Domestic wastes, Industrial wastes, *Organic compounds, Chlorinated hydrocarbons, Chlorophenols.

Ganagagigue Creek is a minor tributary of the Grand River which in turn empties into Lake Eric. It receives domestic and industrial sewage effluent from the town of Elimira, Ontario, as well as leachates from a disused chemical waste dump. The latter appears to be the principal source of chlorinated contamination of the creek. Freshwater leeches from the creek contain very high residues of chlorophenols, being one to two orders of magnitude greater than levels found in fish, tadpoles and most other benthic invertebrates. Only aquatic oligochaetes, which are a class of annelids closely related to leeches, had comparable residues. Of the four leech species, Dina dubia appears to be the best bioinidicator on the basis of its high bioaccu-

mulation potential for chlorophenols. It is an un-common, geographically restricted species about which little is known. Erpobdella punctata, Glossi-phonia complanata and Helobdella stagnalis are all common and widespread in North America and their use would permit comparisons among areas which are widely separated geographically. W85-01958

ADSORPTION OF SURFACTANTS ON SEDI-MENTS,

Yokohama National Univ. (Japan). Dept. of Safety and Environmental Engineering. K. Urano, M. Saito, and C. Murata.

Chemosphere, Vol. 13, No. 2, p 293-300, 1984. 10 Fig, 5 Tab, 5 Ref.

Descriptors: *Fate of pollutants, *Adsorption, *Isotherms, *Surfactants, Rivers, Sediments, River

Surfactants are abundantly used for a wide range of industrial and domestic uses, and they are dis-charged into wastewater, which in turn contamicharged into wastewater, which in turn contami-nates the water environment. Adsorption isotherms of 5 priority surfactants on 7 river sediments were obtained and discussed for presumption of the fate of surfactants in water environment. The adsorp-tion abilities of the sediments seemed to be indetion abilities of the sediments seemed to be inde-pendent of the surface area and to be related to the organic carbon contents. The surfactants were ready to adsorb in the same order as their adsorp-tion on microorganisms. The adsorbed amounts per gram of the organic carbon in the sediments were nearly equal for most of the sediments stud-ied. (Baker-IVI) W85-01960

METHOD FOR TOTAL ORGANIC CHLORINE DETERMINATION IN BLEACH PLANT RE-CIPIENT WATERS,

Abo Akademi, Turku (Finland). Lab. of Forest Products Chemistry. J. Hemming, and B. Holmbom. Chemosphere, Vol. 13, No. 4, p 513-520, 1984. 2 Fig, 6 Tab, 12 Ref.

Descriptors: *Pollutant identification, *Organic compounds, *Chlorine, *Industrial wastes, Bleach, Particle Induced X-ray Emission, Resin sorbtion,

A method based on XAD-8 resin sorbtion and A method based on XAD-8 resin sorbtion and Particle Induced X-ray Emission (PIXE) was de-veloped for total organic chlorine (TOCl) determi-nations in diluted water solutions with special em-phasis on bleach plant effluents/recipients. PIXE offers a fast and sensitive method for multielemen-tal analysis. The major advantages compared to usual methods for halogen determinations are that no conversion of organo-halogen into halogen-ions is needed and that PIXE discriminates between the different halogens. The method was applied to recipient waters of a kraft bleach plant, and the determined TOCI values were compared with other parameters. The detection limit was about 10 micro g/liter. (Baker-IVI) W85-01962

WATER QUALITY OF LAKE ARLINGTON ON VILLAGE CREEK, NORTH-CENTRAL TEXAS, 1973 TO 1981.

Geological Survey, Austin, TX. Water Resources

For primary bibliographic entry see Field 2H. W85-02042

STANDARDIZATION OF METHODS OF ANALYSIS FOR HEAVY METALS IN SEDI-MENTS,

Institute for Soil Fertility, Groningen (Netherlands).

A. J. de Groot, K. H. Zschuppe, and W. Salomons. Hydrobiologia, Vol. 92, p 689-695, July, 1982. 2 Fig, 2 Tab, 14 Ref.

Sources Of Pollution-Group 5B

Descriptors: *Heavy metals, *Sediment analysis, Sampling, Sample preparation, Chemical analysis, X-ray fluorescence, Neutron activiation analysis,

In studies of heavy metals in sediments, there is a need for standardization of the procedures for sample collection and preservation, chemical analyses and presentation of results. The method and depth of sampling depend on the aim of the investigation and on local sediment conditions, such as consistency of the sediment, rate of sedimentation, diagnetic processes and bioturbation. Therefore no general recommendations can be given in this respect. During collection and preservation, contamination and loss of constituents must be avoided. In sediments, the best means for estimating total contents of metals is digestion with HF, in combination with strong acids. Other methods include X-ray fluorescence and neutron activation analyses. The use of HF is considered objectionable by some laboratories. A reasonable alternative is aqua regia. Because variations in granular composition affect metal contents, it is advisable to use the fraction < 63 micro m for the analysis. Chemiis aqua regia. Because variations in granular composition affect metal contents, it is advisable to use the fraction < 63 micro m for the analysis. Chemical partition of sediments provides an insight into the source of metallic constituents, and their pathways to deposition areas. A three-step extraction procedure, in the sequence 0.1 M hydroxylamine-HC1, H2O2 30% and HF, is proposed. Finally, attention is paid to the anthropogenic enrichment of metals in sediments. The establishment of baseline levels is discussed. (Author's abstract) W85-02104

CHEMICAL DERIVATIZATION ANALYSIS OF PESTICIDE RESIDUES. VIII. ANALYSIS OF 15 CHLOROPHENOLS IN NATURAL WATER BY IN SITU ACETYLATION, Canada Centre for Inland Waters, Burlington (On-

H.-B. Lee, L.-D. Weng, and A. S. Y. Chau. Journal of the Association of Official Analytical Chemists, Vol. 67, No. 4, p 789-794, July-August, 1984. 3 Fig, 4 Tab, 8 Ref.

Descriptors: *Pesticide residues, *Chlorophenols, *Gas chromatography, Natural waters, Chemical analysis, Phenols.

In the presence of KHCO3, phenols in water are acetylated by acetic anhydride directly without pre-extraction. The resultant acetates are extracted by petroleum ether and analyzed by electron capture gas chromatography. This method is simple and involves no more steps than a method which requires no derivatization. The major advantages of the method are that phenol acetates are much easier to recover from water samples and they are or the method are that phenol acetates are much easier to recover from water samples and they are also easier to chromatograph on gas chromatography columns than free phenols. The method applies to the di-, tri-, tetra-, and pentachlorophenols in natural waters from 100 to 0.01 ppb with 1 L water sample. (Moore-IVI)

DETERMINATION OF PHENOLS IN WATER USING RAMAN SPECTROSCOPY, Florida State Univ., Tallahassee. Dept. of Chemis-

try.

N. A. Marley, C. K. Mann, and T. J. Vickers.
Applied Spectroscopy, Vol. 38, No. 4, p 540-543,
July/August, 1984. 4 Tab, 16 Ref. NOAA contract
NA82AA-D-00012.

Descriptors: *Phenols, *Raman spectroscopy, *Water analysis, Chlorophenols, Spectroscopy.

The potential of Raman spectroscopy for quantitative analysis of phenols in water solution has been investigated. A group of six compounds - phenol, o-chlorophenol, 2,4-dichlorophenol, 2,4-dichlorophenol, 2,4-dichlorophenol, and 2-chloro-4-nitrophenol - was studied with the use of the 514.5, 488.0, and 487.9 nanometer lines of an argon ion laser. Attention was given to the effects of source intensity, optical alignment, and background fluctuations on quantitative results. It was found that the use of an internal standard with each measurement made a significant improvement in the accument made as a significant improvement made as a significant improvement in the accument made as a significant improvement in the accument in the accum ment made a significant improvement in the accuracy and precision of results. Two methods of

quantitation, peak area measurement and cross-correlation, were used. Results were somewhat better for cross-correlation, presumably because of more effective exclusion of background interfer-ence. Limits of detection were calculated based upon the slope and the standard deviation of the intercept of the standard curve. These varied from the range of 100 ppm to 0.3 ppm, depending on the compound. The most important factor controlling sensitivity is occurrence of resonance enhance-ment. (Author's abstract) ment. (Author's abstract) W85-02114

SIMULTANEOUS DETERMINATION OF PAR-TITION COEFFICIENTS AND ACIDITY CON-STANTS OF CHLORINATED PHENOLS AND GUAIACOLS BY GAS CHROMATOGRAPHY, Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemis-

try. T. M. Xie, and D. Dyrssen. Analytica Chimica Acta, Vol. 160, p 21-30, June, 1984. 2 Fig, 1 Tab, 26 Ref.

Descriptors: *Partition coefficients, *Acidity constants, *Gas chromatography, *Chlorinated phenols, *Guaiacols, Phenols, Organic compounds, Hy-

drogen ion concentration.

The partition coefficients, P, of organic compounds in the n-octanol/water system have been used for the assessment of bioaccumulation potential and the distribution pattern of organic pollutants. The partition coefficients, P, in the n-octanol/water system and the acidity constants, Ka, of 15 chlorinated phenols and guaiacols at 20 degrees were simultaneously determined by investigating the pH dependence of the apparent partition coefficients, Pa. For determining Pa, the relative responses of individual phenols and guaiacols in the aqueous phase after equilibration were measured by glass-capillary gas chromatography with electron-capture detection and compared with those in the octanol phase before partition. Curve-fitting, linear regression, and non-linear regression were used for treating the partition data. The present pKa values of chlorinated phenols and guaiacols are determined simultaneously; thus the surrounding conditions are more nearly identical than in other methods in which the determinations must be done individually. This means that these values may represent a more correct relative relation, which is important in studies of the distribution of these compounds in the environment. In this method, only <1-mg amounts of substance are needed for the pKa determination with an accuracy of 0.1 pKa units, and the purity of the substances is not critical if the impurity separates form the main peak. (Moore-IVI) the main peak. (Moore-IVI) W85-02115

ORGANIZATION AND EVALUATION OF INTERLABORATORY COMPARISON STUDIES AMONG SOUTHERN AFRICAN WATER ANALYSIS LABORATORIES,

National Inst. for Water Research, Pretoria (South R. Smith

Talanta, Vol. 31, No. 7, p 537-545, July, 1984. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Water analysis, *Wastewater analysis, *South Africa, Interlaboratory comparisons, Quality control, Statistical analysis, Standards.

Interlaboratory comparison studies provide a useful 'external' supplement to the various 'internal' quality-control procedures which must be employed in the water-analysis laboratory in order to maintain a high degree of reliability in the production of analytical results. Such studies have been made regularly for many years by various overseas organizations, and were introduced in South Africa in 1976. Since that time 16 studies have been made, involving more than 40 laboratories. In this paper the various factors involved in the successful organization of interlaboratory comparison studies are discussed, and details are given of the sample-preparation, analysis-instruction and result-reporting procedures used in the southern African studies. Techniques used for the statistical evalua-

tion of the analytical results submitted are de-scribed and discussed, for example, methods for the rejection of outliers, measures of securacy and precision, determination of total error, tests of sig-nificance. Greenberg's assessment technique, Maden's ranking technique and Youden's graphical technique. A brief review is given of the studies made to date, along with specific findings and recommendations arising from them. The need for a recognized updated set of standard methods for use by water and wastewater analysis laboratories in southern Africa is highlighted. W85-02117

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES, Benedict Coll., Columbia, SC. Dept. of Chemistry. For primary bibliographic entry see Field 7B. W85-02129

SIMULTANEOUS CONCENTRATION OF FOUR ENTEROVIRUSES FROM TAP, WASTE, AND NATURAL WATERS, Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.

N. Guttman-Bass, and A. Nasser.
Applied and Environmental Microbiology, Vol.
27, No. 6, p 1311-1315, June, 1984. 5 Tab, 18 Ref.
EPA grant R 806588010.

Descriptors: *Enteroviruses, *Drinking water, *Wastewater analysis, *Natural waters, *Israel, Jerusalem, Lake Kinneret, Mediterranean, Cossackie virus, Poliovirus, Echovirus, Water analysis, Virus recovery, Concentration methods.

The efficiency of virus recovery from water was investigated by using a method which enabled the concentration of a mixture of four enteroviruses with determination of their individual recovery efficiencies. The four viruses used (poliovirus 1, coxsackievirus A9, coxsackievirus B1, and echoefficiencies. The four viruses used (poliovirus I, coxsackievirus A9, coxsackievirus B1, and echovirus 7) represented each of the four major subgroups of enteroviruses. This method, which was based on selective antibody neutralization, was used to investigate the effects of input water quality on enterovirus concentration by Balston filters (grade C; Balston, Inc., Lexington, Mass.) and organic flocculation. With tap water, the average recovery efficiency of the four viruses was 97%. Concentration from natural waters, including samples from two lakes (Lake Kinneret and the Hula Nature Reserve) and the Mediterranean Sea, resulted in similarly high average recovery efficiencies. Echovirus 7 was recovered with a slightly lower average efficiency from these types of water than were the other viruses. In comparison with other types of water, virus concentration from Jerusalem wastewater generally had a slightly lower efficiency of recovery, ranging from 63 to 75% for each of the viruses, with an overall average of 63%. The ability of each concentration step, membrane filtration or organic flocculation, to recover the viruses from water was assayed. For the filtration step, although there were not larse differcover the viruses from water was assayed. For the filtration step, although there were not large differences in virus recoveries from tap water, echovirus 7 was recovered with the lowest efficiency (72%), and poliovirus 1 was recovered with the highest (87%) efficiency. Overall virus recovery by the filtration step was least efficient for wastewater (73%) and most efficient for seawater (107%). The organic flocculation step was highly efficient, with essentially all of the virus recovered either as indiessentially all of the virus recovered either as individual viruses or as a mixture. Of the types of water tested, viruses were recovered from seawater with the lowest efficiency. In summary, although some differences in virus recovery were observed for various types of water and individual viruses, the range was not large. Thus, the two-step concentration method used was found to be an efficient general method for enterovirus concentrations. tion from water. (Author's abstract) W85-02137

5B. Sources Of Pollution

GROUNDWATER QUALITY SURVEY OF AN UNSEWERED, SEMI-RURAL AREA,

Group 5B-Sources Of Pollution

Ministry of Works and Development, Christ-church (New Zealand).

L. W. Sinton. New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 317-326, 1982. 4 Fig.

Descriptors: *Christchurch, *New Zealand, *Groundwater pollution, *Water quality, *Well water, Septic tanks, Ammonia, Nitrates, Chlorides, Coliforms, Sewage bacteria, Streptococcus, Bacteria, Streptococcus, Bacteria, Str ria. Conductivity

ria, Conductivity.

A baseline groundwater quality survey of 120 household wells in an unsewered area at Yaldhurst, near Christchurch (New Zealand), was carried out between September and December, 1976. Ammonia-N levels were below the detection limit (0.02 g/cu m) in all samples. Nitrate-N, conductivity, and chloride levels tended to vary according to well depth and location, being lower in the deeper wells and in wells located in an area of shallow, stony soils. Approximately 33% of the wells contained coliform bacteria, fecal coliform bacteria or fecal streptococci. A subset of 25 wells was sampled fortnightly from January to August 1977. From January to June, mean nitrate-N and conductivity levels remained stable at approximately 1.5 g/cu m and 11.2 mS/m respectively. An increase in these levels to 3.3 g/cu m and 15.8 mS/m in July-August corresponded with a rise in the water table. Leaching losses from soils probably accounted for most of the nitrate entering the Yaldhurst aquifers, the contribution by septic tank vastems being estimated as 20.30%. No direct existence the contribution by septic tank vastems being estimated as 20.30%. No direct existence the contribution of the contrib accounted for most of the nitrate entering the Yaldhurst aquifers, the contribution by septic tank systems being estimated at 20-30%. No direct evidence of contamination of the wells by septic tank effluent was found, although 23 of the 25 wells exhibited intermittent contamination by indicator bacteria throughout the 8 month sampling program. Although a localized health hazard may exist, septic tank systems in the area were not considered likely to constitute a health threat to the confined aquifers underlying Christchurch city. (Author's abstract)

W85-01633

WATER QUALITY OF THE WAIOHEWA STREAM, ROTORUA, Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre. R. B. Williamson, and J. G. Cooke. New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 327-337, 1982. 4 Fig. 5 Tab. 32 Ref.

Descriptors: *Waiohewa Stream, *Rotorua, *New Zealand, *Water quality, Nitrogen, Ammonia, Boron, Arsenic, Nitrates, Mercury, Geothermal

The chemical quality of the Waiohewa stream, Rotorua (New Zealand), was assessed from the results of 2 longitudinal surveys in summer 1978-79. In particular, changes in nitrogen concentration were examined. The quantity of ammonia increased downstream from unmonitored geothermal inputs, but, after dilution and neutralization by a larger inflow of freshwater, considerable proportions of ammonia were converted to nitrate. In the first survey ammonia concentrations decreased from 4.48 to 2.47 g/cu m and nitrate concentrations increased from 0.59 to 1.13 g/cu m in a 3-km stretch of the stream. Mass flow calculations show stretch of the stream. Mass flow calculations show that nitrification could account for at least 55% of the ammonia decrease, the rest probably being lost through assimilation or denitrification. Laboratory incubation experiments showed that nitrification occurred in the stream bed. The geothermal waters contained low concentrations of boron (1.1-4.0 g/cu m), filterable mercury (0.1-0.8 mg/cu m) and arsenic (10-14 mg/cu m). (Author's abstract) W85-01634

NITROGEN AND PHOSPHORUS IN THE NGONGOTAHA STREAM, Ministry of Works and Development, Hamilton (New Zealand). Water and Soil Science Centre. R. A. Hoare.

New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 339-349, 1982. 8 Fig,

Descriptors: *Ngongotaha Stream, *New Zealand, *Rotorua, *Nitrogen, *Phosphorus, Base flow, Flood flow, Nitrates, Ammonia, Kjeldahl procedure Nitrates dure. Nutrients.

The nitrogen and phosphorus loads of the Ngongo-taha Stream, near Rotorua, New Zealand were determined for 1976 and 1977 and a novel way to determined for 1976 and 1977 and a novel way to define a flow-concentration curve was developed. There was a clear distinction between total P concentrations in base flow and in flood flow of the stream. In base flow, the concentrations were independent of flow rate, as well as being low, while in floods the concentrations became very strongly dependent on flow rate. Nitrate, ammonia, dissolved reactive phosphorus (DRP), total phosphorus (TP), and total Kjeldahl nitrogen (TKN) concentrations were measured; mean concentrations in 1976 base flow were found to be 527, 25, 32, 48, and 162 mg/cu m respectively. Nitrate concentrations showed seasonal variations, and although changes occurred during floods, they were not correlated with flow rate. DRP concentrations showed by the variation, except that they dropped at not correlated with flow rate. DRP concentrations showed little variation, except that they dropped at the peak of the largest floods. TP was strongly correlated with flow rate during floods, and TP loads could best be calculated by allowing for a curvilinear relationship between concentration and flow rate. The logarithms of the TP load carried by a flood and the peak flow rate of the flood were highly correlated (R = 0.984). The loads of nitrate-N, ammonia-N, DRP, TP, and TKN in 1976 were estimated to be 34, 1.3, 6.0, and 26 tons. (Collier-IVI) (Collier-IVI) 85-01635

SEASONAL STUDY OF A FRESHWATER LAKE AND MIGRATORY WATERFOWL FOR CAMPYLOBACTER JEJUNI, Wisconsin Univ.-La Crosse. Dept. of Biology. G. A. Hill, and D. J. Grimes. Canedian Journal of Microbiology, Vol. 30, No. 6, p 845-849, June, 1984. 1 Fig, 1 Tab, 32 Ref.

Descriptors: *Lake Onalaska, *La Crosse, *Wisconsin, *Campylobacter, *Waterfowl, Birds, Water Birds, Bacteria, Coliforms, Animal wastes, Streptococcus, Water pollution sources.

Streptococcus, Water pollution sources.

Carrier birds may contribute to water-borne transmission of Campylobacter jejuni. Water and sediment samples from Lake Onalaska (Mississippi River navigation pool No. 7), near La Crosse, Wisconsin, were quantitatively examined in the summer and fall of 1981 for C. jejuni and for standard bacterial indicators of fecal pollution. Its location within the Mississippi Flyway makes Lake Onalaska ideally suited as a temporary roosting site for several hundred thousand migratory waterfowl every year. Fifty cecal content samples, representing seven species of transient waterfowl captured during fall migration, were also assayed for C. jejuni. Fecal coliform and fecal streptococcus counts from the water and sediment samples agreed with previously established values for the pool and accurately reflected the influx of approximately 619,000 ducks and geese during fall migration. C. jejuni was not recovered from water, sediment, or fecal samples. This conflicts with previous reports which implied a cosmopolitan distribution of C. jejuni among waterfowl. Chemical and physical analyses of water samples revealed nothing remarkable and certainly offered no explanation for the absence of C. jejuni from Lake Onalaska. Other avian-borne pathogens also exhibit sporadic distribution, influenced by avian feeding pressure, intermingling of water fowl with nonaquatic birds and other animals, and farming practices. C. jejuni cannot be regarded as cosmopolitan among migratory waterfowl. (Collier-IVI)

AROMATIC HYDROCARBONS IN WATERS OF PORT PHILLIP BAY AND THE YARRA RIVER ESTUARY,

Melbourne Univ., Parkville (Australia). Marine Chemistry Lab. J. D. Smith, and W. A. Maher. Australian Journal of Marine and Freshwater Research, Vol. 35, No. 2, p 119-28, 1984. 4 Fig, 2 Tab, 23 Ref. Descriptors: *Australia, *Port Phillip Bay, *Yarra River Estuary, *Corio Bay, *Hobsons Bay, *Hy-drocarbons, Fluorescence emmission spectroscopy, Oil, Terphenyl, Pyrene, Water pollution sources.

Port Phillip Bay, Australia, is a shipping route with onshore oil refineries and with major ports on Corio Bay (Geelong) and Hobsons Bay (Melborne). In this environment, input of aromatic hydrocarbons from petroleum is likely to be dominant over atmospheric inputs of combustion products, with negligible contribution from biochemical processes. Aromatic hydrocarbons provide a useful indicator for assessing the anthropogenic input of hydrocarbons into rivers and the sea. Water samples were taken from Port Phillip Bay, the Yarra River estuary, and Corio Bay. Determination of aromatic hydrocarbons in these waters, using solvent extraction and fluorescence emission analysis, showed a wide distribution of fuel oils with only a small contribution from crude oil. Oil concentrations were reported as equivalent amounts of m small contribution from crude oil. Oil concentrations were reported as equivalent amounts of mterphenyl (T) or pyrene (P). Observed concentrations in Port Phillip Bay were generally 0.2-0.3
micro g/L (T) and 0.1-0.2 micro g/L (P), with
higher values in Corio Bay and the Yarra River
estuary. All areas with elevated levels of aromatic
hydrocarbons contained major contributions from
refined oils (including lubricating oils); the area
with aromatic hydrocarbon concentrations approaching background levels appeared to have fuel
oil as the major source of contamination. (CollierIVI)
W83-01644 W85-01644

OIL SPILL FOCUSES ATTENTION ON THE PROBLEMS OF A MAN-MADE RECREATION-

Toledo Univ., OH. G. F. Bennett, G. R. Kunkle, E. J. Tramer, C. E. Stoops, Jr., and R. H. Scheidel. Journal of Environmental Systems, Vol. 14, No. 1, p 31-49, 1984-83. 3 Fig. 7 Tab, 13 Ref.

Descriptors: *Holiday Lake, *Williard, *Ohio, *Oil spills, *Water pollution effects, Path of pollutants, Systems analysis, Costs, Cleanup, Fate of

when a runaway diesel engine fell into a turntable pit at a railroad maintenance facility, its oil tanks ruptured releasing 4,000 gallons of No. 2 diesel oil that subsequently flowed through sewers to an agricultural stream that led to Holiday Lake, Williard, Ohio, an inland, man-made lake; two days later the lake residents awoke to find 'wall to wall' oil covering the water surface. The oil quickly disappeared, but not the anger of the property owners who sued the railroad for \$1.2 million to dredge the oil-containing sediments 'from the lake bottom,' claiming not only that the spill had added oil to the benthic sediments but also chronic pollution from poorly designed and operated wastewater treatment units had impacted the lake. To obtain data for the pending court suit, the defense attorneys assembled a team of scientists and engineers who used a systems approach to evalute the lake, its water quality inputs into it, and impact of the oil on it. (Author's abstract)

DISTRIBUTION AND PERIODICITY OF TOTAL, FAECAL COLIFORM BACTERIA IN AN AQUATIC ECOSYSTEM,

AN AQUATIC ECOSYSTEM, Jawaharlal Nehru Univ., New Delhi (India). Mi-crobiological Lab. U. S. Bagde, and A. K. Varma. International Journal of Environmental Studies, Vol. 19, No. 3/4, p 215-220, 1982. 3 Fig, 1 Tab, 20

Descriptors: *New Dehli, *India, *Coliforms, *Lakes, *Bacteria, Escherichia coli, Shigella , Salmonella, Vibrio, Public health.

Some strains of Escherichia coli have been recog-nized as pathogens in recent years and thus E. coli should no longer be considered as just an indicator and nonpathogenic bacterium of fecal pollution. A bacteriological study of the water of a lake at

Sources Of Pollution-Group 5B

Jawaharial Nehru University, New Delhi, was carried out during 1979-80 for the period of one year. The quality of water was assessed to establish the pattern of periodicity and seasonal variations of total and fecal coliform bacteria. Extreme variations were found in the bacterial counts in different samples collected from the lake water, at the same time. There existed a positive correlation between total coliform and faecal coliforms. In addition to the presence of E. coli and A. aerogenes in large numbers in the water, the isolation of pathogenic bacteria, Vibrio, Shigella, and Salmonella, give a definite indication of its fecal pollution. The bacteriological quality of water was much below the recommended standards for recreational and drinking waters. (Collier-IVI) W85-01675

STOCHASTIC MODEL FOR BOD AND DO IN STREAMS WHEN THE VELOCITY IS RANDOM AND DISTANCE-DEPENDENT, North Carolina Univ. at Charlotte. Dept. of Math-

emaucs. A. S. Papadopoulos. International Journal of Environmental Studies, Vol. 19, No. 3/4, p 263-267, 1982. 5 Fig, 11 Ref.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Model studies, Mathematical models, Path of pollutants, Wastewater pollution.

In the past, several mathematical models have disin the past, several mathematical models have dis-cussed the pollution caused in rivers and streams by the discharge of organic waste materials. A new model was developed which more realistically pre-dicts the amount of biochemical oxygen demand (BOD) and dissolved oxygen (DO) at any point on a stream. This stochastic model is a random differential equation of the form X(t)=A(t) X(t)=Y(t), t > or = 0, with initial conditions X sub 0=X(0). X(t) is a vector with BOD and DO at a distance t A(t) is a vector with BOB and BOB at a distance to downstream from the pollution source for components. The velocity of the stream is incorporated into the vector A(t) and is random and distance dependent. The inhomogeneous term Y(t) and the initial conditions are random vectors. Therefore, this model contains random initial conditions, random coefficients and random inhomogeneous terms. Simulated trajectories of the BOD and DO were computed with their joint density assumed to be bivariate normal with correlation coeffecient rho and the densities uniform. (Collier-IVI)

INFLUENCE OF RAINFALL CHARACTERISTICS ON THE POLLUTION EMISSION, DHV Consulting Engineers, Amersfoort (Nether-For primary bibliographic entry see Field 2E. W85-01697

METHODS FOR CALCULATION OF ANNUAL AND EXTREME OVERFLOW EVENTS FROM COMBINED SEWER SYSTEMS,

Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 2E.
W85-01699

MICROORGANISM SURVIVAL IN AN ICE-COVERED RIVER, Alberta Univ., Edmonton. Dept. of Civil Engi-

G. Putz, D. W. Smith, and R. Gerard. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 177-186, June, 1984. 9 Fig, 3 Tab, 11 Ref.

Descriptors: *Microorganisms, *Sewage bacteria, *Indicators, *Ice cover, *Slave River, *Northwest Territories, *Survival, Coliforms, Wastewater disposal, Stream pollution, Bacteria, Fate of pollutants, Source of pollutants.

Persistence of microorganisms in rivers represents a complex situation that simultaneously involves both transverse mixing and decay. Microorganism decay characteristics were determined for ice-cov-ered conditions in the Slave River downstream of the Fort Smith, Northwest Territories, wastewater

disposal site. The Fort Smith wastewater treatment and disposal system consists of two primary lagoon cells and a facultative cell, followed by a continucells and a facultative cell, followed by a continuous discharge to the Slave River through a submerged near-shore outfall. Microorganism sampling and analyses for total and fecal coliforms were conducted for each sampling station. After accounting for the physical dilution the limited data showed a barely discernible microorganism die-off within the study reach for the ice-covered conditions. These conditions generally represent periods in which indicator bacteria concentrations perists the longest owing to low water temperatures, isolation from sunlight, and minumum river flow conditions. (Collier-IVI)

MIXING ZONE STUDIES IN THE GRAND RIVER BASIN,

Gore and Storrie Ltd., Toronto (Ontario). Water Resources Div.
T. P. H. Gowda, and L. E. Post.
Canadian Journal of Civil Engineering, Vol. 11,
No. 2, p 204-216, June, 1984. 8 Fig. 7 Tab, 11 Ref.

Descriptors: *Mixing zone, *Path of polluta *Grand River Basin, *Ontario, *Speed Riv Zone of passage, Wastewater treatment, Ammo Chlorine, Water quality management.

Chlorine, Water quality management.

In a stream that receives wastewater effluent, provincial water quality objectives require maintenance of a specific portion of the cross section of the stream termed the 'zone of passage' (ZOP) wherein the concentrations of the pollutants comply with a specified water quality objective. A steady state mathematical model based on the 'stream tube' concept was utilized to evaluate the impact of various viable management options on the mixing zone boundaries for nonionized ammonia and total residual chlorine at the Grand River below Waterloo, Kitchener, and Galt (Ontario), and the Speed River below Guelph (Ontario). The options evaluated as part of the Grand River Basin Water Management Study include various river flows and effluent flows projected for the planning period 1981-2031. The predictions indicate that a ZOP equal to 60% of river flow is attainable for chlorine in all cases except in the Speed River below Guelph beyond the year 2001, and in-plant intiffication is required at Waterloo and Kitchener under the present conditions in order to comply with the objective for nonionized ammonia. At Guelph, with in-plant nitrification, the ammonia objective will not be met for existing and future summer conditions and for winter conditions beyond the year 2001. For Galt, the ammonia objective is met with conventional secondary treatment under all options. (Collier-IVI)

BEACH FECAL COLIFORMS, Gore and Storrie Ltd., Toronto (Ontario). M. D. Palmer, and R. J. Dewey. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 217-224, June, 1984. 7 Fig. 3 Tab, 1

Descriptors: *Coliforms, *Beaches, *Ottawa River, **Contario, Model studies, Water quality management, Rainfall-runoff relationships, Prediction, Cost analysis, Offshore momentum diffuser, Piers.

The urban beach on the Ottawa River at Britann in the city of Ottawa, has been closed periodically by health officials for fecal coliform levels in excess of 100 counts/100 mL. These events were excess of 100 counts/100 mL. These events were generally related to rainfall events. A combination of the STORM runoff model and a two-dimensional dynamic lake type model successfully reproduced the fecal coliform levels of the beach. Elevated fecal coliform levels were associated with rainfall events and runoff from two large catchments upstream of the beach. Due to prevailing conditions in the lake, the second largest summer storm did not produce elevated fecal coliform levels while the third and fourth larges' storms did. The models predicted these events. The STORM model was calibrated on a subcatchment and supplied tha runoff flow volumes and pollution levels to the dynamic lake model. The other input data

for the lake model were supplied by field measure-ments. The models were used to assess the effec-tiveness of management options to improve the water quality on the beach. Options studied in-clude extension of the Britannia Pier, installing an clude extension of the Britannia Pier, installing an offshore momentum diffuser, and removing the effects of one or two of the major upstream drainage basins. The cheapest option that ensures aceptable beach water quality is the pier extension, but this option requires an affective die-off of fecal coliforms. The next best solution is the offshore momentum diffuser, which also requires a 60 m extension to the Britannia pier. (Moore-IVI)

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-

Severn-Trent Water Authority, Birmingham (England).

R. Morris, and D. N. Sharp. Water Research, Vol. 18, No. 11, p 935-939, 1984. 4 Fig, 1 Tab, 10 Ref.

Descriptors: *Enteroviruses, *Effluents, *Surface waters, *England, Coxsackie virus, Echovirus, Poliovirus, Water storage, Path of pollutants.

Large volumes of wastewater effluent are being discharged into rivers, many of which are being used for potable supply. Viral surveillance of 381 wastewater effluents and 533 surface waters was carried out between January 1979 and July 1981 within the Severn Trent Water Authority's area. Enteric viruses were detected in 45% of the samples of effluents and in 48% of the samples of surface waters. Viral levels in effluents varied considerably with highest recovered being 31,000 plaque forming units per liter (pfu/l). A substantial number of effluent samples gave levels lower than the practical detection limit of 100 pfu/l. Levels were markedly lower in surface waters, the highest being 647 pfu/l. River water which had received long-term bankside storage only yielded virus infrequently. A total of 1283 isolates from 914 samples of wastewater effluents and surface waters were successfully subcultured and identified. Only three echovirus serotypes were identified. The poloviruses showed a broadly recurring pattern probably associated with vaccination programs. Coxackie groun B viruss were common than existence. ably associated with vaccination programs. Cos-sackie group B viruses were common than polio-viruses with only type 6 not being recorded. (Moore-IVI) W85.01718

STUDY OF THE COPPER-COMPLEXING COMPOUNDS RELEASED BY SOME SPECIES OF CYANOBACTERIA, Liverpool Univ. (England). Dept. of Botany. W. F. Jardim, and H. W. Pearson.
Water Research, Vol. 18, No. 8, p 985-989, 1984. 5

Descriptors: *Cyanophyta, *Copper, *Metal com-plexing, Plectonema, Anabaena, Conditional stabil-ity constants, Heavy metals.

The production of copper-complexing extracellular material by cyanobacteria was studied by using ion specific electrodes. The species studied were Plectonema boryanum and Anabaena cylindrica. The values of the conditional stability constants for the copper complexes (K°), for the two species at pH 6.60 (+/-0.05) were, respectively 2.8 (+/-0.8) x 10 to the 6th and 5.9 (+/-2.0) x 10 to the 7th. A strain of P. boryanum that was made tolerant to a concentration of 1 x 10 to the -6th M copper produced greater amounts of copper-complexing produced greater amounts of copper-complexing products than the normal strain although the K' value for the copper complexes was the same.
When stressed with copper, P. boryanum and A.
cylindrica produced more complexing material
than under the usual growth conditions. (Author's abstract) W85-01725

FORMATION OF STABLE ORGANIC CHLOR-AMINES DURING THE AOUEOUS CHLORIN-

Group 5B-Sources Of Pollution

ATION OF CYTOSINE AND 5-METHYLCYTO-

Georgia Inst. of Tech., Atlanta. School of Civil

For primary bibliographic entry see Field 5F.

KINETICS AND PRODUCTS OF THE CHLOR-INATION OF CAFFEINE IN AQUEOUS SOLU-

Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.

J. P. Gould, and J. T. Richards.

Water Research, Vol. 18, No. 8, p 1001-1009, 1984. 13 Fig, 2 Tab, 14 Ref.

Descriptors: *Caffeine, *Chlorination, Wastewater, Natural waters, Hypochlorous acid, Chemical reactions, Chlorocaffeine, Kinetics.

Among the low molecular weight organic com-pounds which have been identified in wastewaters and natural waters is the purine base caffeine. This compound is present as a direct result of the concompound is present as a truck result in the con-sumption of coffee. The reaction between aqueous hypochlorous acid and caffeine was found to be dependent on pH only to the extent that it influ-ences the fraction of FAC which is in the form of ences the fraction of FAC which is in the form of HOCl. The rate constant had a value of 162 +/32/M sq/s. For each mol of caffeine consumed, 6.3 mol of FAC were consumed. The chlorination reaction proceeded primarily by ring cleavage and rearrangement forming nononromatic nitrogen herocytes. 8-Chlorocaffeine was unequivocally identified as an aqueous chlorination product but was found to be formed only to a small extent and under rather limited conditions. No stable organic chloramines were formed. (Moore-IVI) W85-01727

REMOVAL OF VOLATILE ORGANIC POL-LUTANTS FROM RAPID STREAMS,

New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.

F. Cadena, G. A. Eiceman, and V. J. Vandiver. Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 460-463, May, 1984. 4 Fig, 1 Tab,

Descriptors: *Benzene, *Chlorobenzene, *Volatilization, *Organic compounds, *Rivers, Model studies, Volatile compounds, Model studies, Fate of rollutants.

An integrated theory of volatilization of volatile organic compounds (VOCs) in rivers is presented and a volatilization model for direct use with rivers is described. Advantages and features of this model are demonstrated with theoretical applications and large-scale modeling studies. Discussion is restricted to certain volatile compounds. Thirty-one of 165 priority pollutants have been defined by the US EPA that are volatile enough to be controlled only by liquid-phase diffusion. In this study the volatilization rates of benzene and chlorobenzene and the reaeration coefficient were measured using a 1000-L closed circuit circular stream. Saturated a 1000-L closed circuit circular stream. Saturated aqueous solutions of two VOCs chosen for modelaqueous solutions of two VULs chosen for modering were prepared. The reaeration rate of the stream was contolled by changing the angular velocity of the rotating walls and by varying the water depth and bottom configuration. The range of reaeration coefficient covered in this study was from 0.14 to 1.96/hr. The VOC concentration range measured in the volatilization experiments from 0.14 to 1.96/hr. The VOC concentration range measured in the volatilization experiments was from about 1.0 mg/L to as low as 1.0 micro g/L. A hypothetical example was selected to illustrate the simplicity of the model for prediction of toxic VOC movement in streams - an accidental discharge of methylene chloride and 1,4-dichloro-heazene at the Interstate Highway 25 bridge over the Rio Grande, immediately below Albuquerque New Mexico, with river flow at minimum flowrate conditions. The chemical spill is assumed to be immediately mixed with the river water at 20 C. The model is used to predict the expected concentration fraction remaining for the pollutants as a function of time and distance. (Baker-IVI) W85-01738 W85-01738

ANALYSIS OF AQUEOUS SEDIMENTS FOR HEAVY METALS,
Texas Southern Univ., Houston. Dept. of Chemis-

V. O. Ogugbuaja, R. R. Schwarzer, and B. L.

Wilson.

Journal of Environmental Science and Health,
Vol. A(19), No. 8, p 911-924, December, 1984. 3
Fig. 2 Tab, 19 Ref. DOE grant ER-78-G-05-6079.

Descriptors: *Heavy metals, *Lake sediments, *Industrial wastes, *Powerplants, *Houston, *Texas, Cadmium, Copper, Zinc, Iron, Manganese, Sediments, Spectroscopy.

Atomic absorption spectroscopy was used to determine the concentrations of Cd, Cu, Zn, Fe, and Mn in sediments from lakes around a coal-powered electric generating plant in southwest Houston, Texas. The plant had been operational for only about one year at the time of sampling. As a result, the variations of trace metals with depth are considered to be essentially unaffected by the plant. The concentrations for each trace metal within a lake remained roughly the same. An attempt was made to correlate the trace metals with percent clay and organic carbon, but no trend was evident. (Baker-IV1)

HEAVY METALS IN THE LOWER MISSISSIP-

PI RIVER, Centre National de la Recherche Scientifique, Paris (France). E. J. Newchurch, and I. A. Kahwa.

Journal of Environmental Science and Health, Vol. A(19), No. 8, p 973-988, December, 1984, 11 Fig, 3 Tab, 14 Ref.

Descriptors: *Heavy metals, *Fate of pollutants, *Mississippi River, *Suspended sediments, Rivers, Arsenic, Lead, Mercury, Cadmium, Chromium, Copper, Filtration, Settling, Water treatment.

Samples of water from the Mississippi River were examined regularly to determine their content of heavy metals. Between 1978 and 1983, river water concentrations at individual sampling sites exceeded the drinking water standards 1 to 3% of the time for each size of the standards 1 to 3% of the time for each size of the standards 1 to 3% of the time for cadmium, chromium and copper; 7 to 9 % of the time for arsenic and lead; and 18% of the time for mercury. Arsenic, cadmium and chromium appear to be carried predominantly by the total dissolved solids and should be removed in the usual water treatment steps of coagulation followed by the control of the coagulation followed by the coagulation followed by the categories of the coagulation followed by the categories of the coagulation followed by the categories of the c usual water treatment steps of coagulation to-lowed by settling and/or filtration. Copper and lead appear to be carried, at least partly, in dis-solved form, while additional data are needed for mercury. (Baker-IVI) W85-01744

MINES: A MODEL TO FORECAST MINE WASTEWATER QUALITY,

Durham Univ. (England). J. F. Bell, and M. J. Reeves International Journal of Environmental Studies, Vol. 20, p 47-52, 1982. 1 Fig, 20 Ref.

Pescriptors: *Mine wastes, *Forecasting, *Wastewater, Mine drainage, Acid mine drainage, Computer models, Pyrite, Water pollution sources, Weathering, Model studies.

The minerals exposed by mining operations are abruptly subjected to a major change in their chemical and physical environment and undergo mechanical and chemical degradation (weathering). As a direct consequence, large quantities of water soluble compounds may be released and dissolved in percolating groundwater and surface waters. The breakdown of the mineral pyrite is a particularly important aspect of weathering in coal and metalliferous mines since acid ferruginous drainage waters can be produced. A probability model formulation procedure is suggested, including a description of the model MINES which was developed to forecast the likelihood and type of acid and ferruginous mine drainage occurring in a specific situation. MINES was validated on the basis of its ability to correctly forecast mine sis of its abiliity to correctly forecast

wastewater quality in well-docum ries in the literature. (Moore-IVI) W85-01750 mented case histo-

TRACE METAL CONCENTRATIONS OF THE WATERS OF A SOUTH INDIAN RIVER, Mysore Univ. (India). Dept. of Botany. R. K. Somashekar, S. N. Ramaswamy, and G. D.

International Journal of Environmental Studies, Vol. 20, p 63-65, 1982. 3 Tab, 25 Ref.

Descriptors: *Heavy metals, *Path of pollutants, *Kapila River, *India, Copper, Lead, Cadmium, Nickel, Cobalt, Chromium, Zinc, Water analysis.

Copper, zinc, lead, cobalt, chromium, cadmium and nickel were analyzed in both surface and bottom water samples at six sampling stations of the river Kapila, Karnataka, India. Concentrations of the various metals varied from station to station. The variation was due to difference in the degrees of pollution which are of domestic and industrial origin. Bottom samples had more dissolved metals than the surface water samples. Copper concentrathan the surface water samples. Copper concentra-tion was above the highest desirable limit at 3 stations which receive much domestic waste. Lead and cadmium concentrations were above the maxi-mum permissible levels at all stations. Chromium concentration was very low at all stations except one and nickel concentration at 2 stations was high compared to the other stations. At the less polluted stations metal concentration is higher during summer, followed by rainy and winter seasons. At the more polluted stations maximum readings were recorded during winter, followed by summer and rainy seasons. This variation is attributed to variance in effluent load added to the river and the amount of discharge of water from the dam. W85-01751

ROLE OF SEDIMENTS IN THE NITROGEN BUDGET OF LOWER GREEN BAY, LAKE MICHIGAN,

Army Engineer Waterways Experiment Stati Vicksburg, MS. Environmental Lab. R. L. Chen, D. R. Keeney, and T. H. McIntosh. Waterways Experiment Station, Journal of Great Lakes Research, Vol. 9, No. 1, p 23-31, 1983. 2 Fig, 7 Tab, 27 Ref.

Descriptors: *Green Bay, *Lake Michigan, *Lake sediments, *Nitrogen, Water pollution sources, Cycling nutrients, Limiting nutrients, Eutrophication, Nonpoint pollution sources, Nitrification, Denitrification, Water pollution control.

The extreme southern portion of Green Bay is a shallow (1 to 5 m depth), eutrophic water body which receives considerable nutrients from the Fox River and metropolitan Green Bay, Wisconsin. Research to evaluate the effect of sediments on nitrogen (N) in the bay entailed periodic sampling of waters and sediments at six sites over 20 months and laboratory investications of the rates of sixthese. and laboratory investigations of the rates of nitrifi-cation, denitrification, mineralization, immobiliza-tion, and N2 fixation. The monitoring data indicattion, and N2 fixation. The monitoring data indicated that the N concentrations, approximately 0.6 and 0.8 mg/L of inorganic and organic N, respectively, in the bay waters are considerably higher than the threshold limits that may cause algal bloom and aquatic weed problems. Consideration of the available sediment N pool with respect to recognizable N inputs indicated that only 1.2% of the yearly N loading from the Fox River is present in the active sediment layer. Nitrification and subsequent denitrification at the sediment-water interface as a result of intermittent wind stirring could face as a result of intermittent wind stirring could lace as a result of intermittent wind stirring could be a major sink for N, but presently it has a minor impact due to the high loading rate of N in this ecosytem. The study indicates that even if approximately 50% of the present point source loading of N were eliminated by pollution abatement, the N input from nonpoint sources (combined with existing concentrations of phosphorus in the bay waters) would be sufficient to maintain eutrophic conditions. (Author's abstract)

Sources Of Pollution-Group 5B

NET ATMOSPHERIC INPUTS OF PCBS TO THE ICE COVER ON LAKE HURON, De Paul Univ., Chicago, IL. T. J. Murphy, and A. W. Schinsky. Journal of Great Lakes Research, Vol. 9, No. 1, p 92-96, 1983. 3 Fig., 1 Tab., 12 Ref. EPA grant R805325.

Descriptors: *Atmospheric deposition, *Polychlo-rinated biphenyls, *Ice cover, *Lake Huron, Water pollution sources, Precipitation, Conductivity, Ice

Protected areas of the Great Lakes usually are completely frozen over for 8-12 weeks each winter. During this time, the ice surface accumulates precipitation and dry deposition, and the materials they contain. When the ice melts in the spring, all these material go into the lake. Measurements of the net atmospheric deposition of PCBs were made on ice cores collected from the frozen surface of Lake Huron late in the ice seasons of 1978 and 1979. Ice cores were separated into segments and melted. Based on subjective appearance and specific conductivity, the segments were divided into a depositional layer sample (cloudy, high specific conductivity) or a frozen lake water (clear, low specific conductivity) sample. Intrusions of specific conductivity) or a frozen lake water (clear, low specific conductivity) sample. Intrusions of lake water into the accumulated deposition layer of ice and snow were not encountered. For Saginaw Bay, a net deposition rate of 2.0 gm/sq km/mo of PCBs to the ice was found for the winters of 1971-1978 and 1978-1979. Upon ice break-up and thaw in the spring, all of the PCBs accumulated on the ice are likely to enter the bay. For inner Saginaw Bay, this would have been 8 kg in March 1978 and 6.5 kg in March 1979. The analysis of ice cores, a method which had been tried but not found to be useful for determining accumulated atmospheric deposition on small lakes, worked very well for frozen areas of the Great Lakes. (Moore-IVI) W83-01759

HEAVY METALS IN ULVA LACTUCA COL-LECTED WITHIN TOLO HARBOUR, AN ALMOST LANDLOCKED SEA, Chinese Univ. of Hong Kong, Shatin. Dept. of

Biology. M. H. Wong, T. T. Kwok, and K. C. Ho. Hydrobiological Bulletin, Vol. 16, No. 2-3, p 223-230, December, 1982. 2 Fig, 3 Tab, 32 Ref.

Descriptors: *Heavy metals, *Harbors, *Path of pollutants, *Tolo Harbor, *Hong Kong, Copper, Zinc, Lead, Iron, Aquatic plants, Bioindicators.

Tolo Harbor is an almost land locked sea with only a narrow outlet. The size and volume of the harbor have constantly decreased since the construction of the Plover Cover Reservoir in the late 1960s. The large scale reclamation due to the expansion The large scale reclamation due to the expansion and development of two satellite cities, Tai Po and Shatin as well as the construction of a race-course and circular roads in the late 1970s have further reduced the size and volume of the harbor, and affected the natural habitats of the shore-lines. The dilution effect of the tides and waves within Tolo Harbor has become minimal. There is a high content of heavy metals in the coastal water discharged from various industries including taxtile. charged from various industries including textile, wig and electroplating factories. Samples of seawater, sediment and U. lactuca were collected from different localities within, as well as far away from Tolo Harbor, in order to gain an understand-ing of the metal content of the alga and seafood collected within the harbor. Water and sediment collected within the harbor. Water and sediment analyses revealed higher concentrations of metals (copper, iron, lead, and zinc) within the harbor. Samples of algae from the most polluted area, Yuen Chau Tsai, had the highest contents of all tested metals with 134 micro g/g of copper. The extent of metal contamination was emphasized in the findings in the tissue of U. lactuca. Use of U. lactuca, one of the most common marine algae in Hong Kong, as a biological indicator would be valuable. (Baker-IVI) W85-01762

STATISTICAL ANALYSIS AND EVALUATION OF WATER-QUALITY DATA FOR SELECTED STREAMS IN THE COAL AREA OF EAST-CENTRAL MONTANA,

Geological Survey, Helena, MT. Water Resources

Div.
J. H. Lambing.
A vailable from the OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4224, 1983. 89 p, 15 Fig, 8

Descriptors: *Water quality, *Statistical analysis, Regression, Flow duration, *Sediment load, Sedi-ment yield, *Dissolved solids, *Montana, Fort

Union coal region.

To document and evaluate existing conditions of water quality prior to proposed coal development in east-central Montana, water-quality data were collected at 23 sites on selected streams from October 1975 through September 1981. The data were statistically summarized and regression equations were developed to define relationships between water-quality variables. Where applicable, measured water-quality conditions were compared to various water-use standards. Measured concentrations of dissolved solids ranged from 145 to 12,200 milligrams per liter. Concentrations commonly exceeded 1,000 milligrams per liter and thereby present a high to very high salinity hazard for irrigation. Streamflow of the area contains predominantly sodium and sulfate ions and generally constitutes a medium to very high sodium hazard for irrigation during base flow. The water in most streams is generally adequate for livestock consumption during base flow. Concentrations of suspended sediment were extremely variable and had direct correlation to water discharge. Measured suspended-sediment concentrations ranged from 4 to 23 000 milligrams per liter. Sediment-transport a direct correlation to water discharge. Measured suspended-sediment concentrations ranged from 4 to 23,000 milligrams per liter. Sediment-transport curves were developed for 18 of the study sites. Mean annual suspended-sediment loads were determined at five sites using the flow-duration, sediment-transport curve method. Mean annual sediment loads ranged from 1,010 to 72,7000 tons. (USCIS) (USGS) W85-01770

ORIGINS AND DISTRIBUTION OF SALINE GROUND WATERS IN THE FLORIDAN AQUI-FER IN COASTAL SOUTHWEST FLORIDA, Geological Survey, Tallahassee, FL. Water Resources Div. For primary bibliographic entry see Field 2K. W85-01778

HYDROLOGIC RESPONSES OF STREAM'S TO MINING OF THE MULBERRY COAL RESERVES IN EASTERN KANSAS, Geological Survey, Lawrence, KS. Water Resources Div. For primary bibliographic entry see Field 2E. W85-01782

GROUND-WATER QUALITY IN THE WEST-ERN SNAKE RIVER BASIN, SWAN FALLS TO GLENNS FERRY, IDAHO, Geological Survey, Boise, ID. Water Resources

Div. For primary bibliographic entry see Field 2F. W85-01784

MUNICIPAL SOLID-WASTE DISPOSAL AND GROUND-WATER QUALITY IN A COASTAL ENVIRONMENT, WEST-CENTRAL FLORIDA, Geological Survey, Tallahassee, FL. Water Re-sources Div. For primary bibliographic entry see Field 5E. W85-01789

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE BLOOMFIELD COAL TRACT, DAWSON COUNTY, EASTERN MONTANA, Geological Survey, Helena, MT. Water Resources Div.

For primary bibliographic entry see Field 2F. W85-01791

USE OF FIXED-BED ADSORBER MODELS TO PREDICT THE FLUXES OF TOXIC SUB-

STANCES IN GROUNDWATERS AND SOIL ENVIRONMENTS.

Michigan Univ., Ann Arbor. Dept. of Civil Engi-W. J. Weber, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202563, Price codes: A05 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State Univ., East Lansing, January 1984, 92 p. 44 Fig. 2 Tab, 40 Ref. Project No. OWRT A-12-MICH(1), Contract/Grant No. 14-34-0001-

Descriptors: *Mathematical models, *Soil, *Toxic substances, *Groundwater, Kinetics, Organic carbon, Model studies, *Path of pollutants, *Sorption, Sands, Lindane, *Freundlich isotherms, *Solute transport, Mass transport.

Effective management of a ground water system requires description and prediction of the transport and fate of contaminants in that system. This can be facilitated by using mathematical models which accurately represent the physical phenomena operative in the system. One of the most significant phenomena impacting the transport of many organic pollutants is partitioning between the solid (soil) and aqueous (groundwater) phases. The tendency of a contaminant to partition may be roughly ency of a contaminant to partition may be roughly approximated from measurements of such constituapproximated from measurements of such constitu-tive properties as the octanol: water partition coef-ficient of the contaminant and organic carbon con-tent of the soil. Such rough approximations pro-vide a basis for cursory appraisal, but are inad-equate for quantitative system descriptions, parti-culary where nonlinear equilibrium sorption, kine-tically dependent partitioning, or irreversible and/ or hysteretic phase distribution phenomena are op-erative. Accurate simulation of solute transport frequently requires the incorporation of kinetic parameters and/or a nonlinear isotherm relation-ship to define transport phenomena in the funda-mental equations governing mass transport. Data collected for four sands and lindane indicates that equilibrium sorption is a nonlinear function best fit by the Freundlich isotherm. Results collected from completely mixed batch reactors of the bottle and stirred type indicate that sorption of lindane on the completely mixed outch reactors of the ootte and stirred type indicate that sorption of lindane on the soils investigated is a kinetically controlled phe-nomena. These kinetic sorption data may be math-ematically modeled in a number of ways with the Michigan Adsorption Design and Applications Model (MADAM) demonstrating good agreement with measured data with measured data W85-01793

EFFECTS OF PHOSPHATE FERTILIZER AP-PLICATIONS AND CHEMISTRY-MINERALO-GY OF THE IRON OXIDE SYSTEM ON PHOS-PHATE ADSORPTION-DESORPTION STREAM SEDIMENTS,

Ohio State Univ., Columbus. Dept. of Agronomy. T. J. Logan, J. M. Bigham, K. S. Brady, and P. S.

Nair.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202571, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, Columbus, Project Completion Report No. 712429, (1984). 102 p. 12 Fig. 19 Tab, 93 Ref. Project No. OWRT B-080-OHIO(1), Contract/Grant No. 14-34-0001-0242.

Descriptors: Eutrophication, *Acid mine water, Sulfates, Sediments, *Ohio, *Iron oxides, Pyrite, Anion adsorption, Prototype tests, *Mine drainage, *Phosphate adsorption, Phosphorus adsorption procedure, Muskingum River basin.

Suspended sediments from the Muskingum River and its tributaries were remarkably uniform in mineralogy and size distribution. Black Fork Creek, a tributary to Moxahala Creek which receives acid drainage from abandoned coal mines was chosen for detailed water quality and bottom sediment studies. Marked increases in dissolved SO4, Fe, and Al, and decreased pH were observed in sections of the stream affected by acid mine drainage. In addition, a gelatinous yellow iron precipitate was abundant in the bottom sediments below sources of pollution. This Fe-oxide or oxyhydrox-

Group 5B—Sources Of Pollution

ide precipitate greatly increased surface area and reactivity of bottom sediments and added to the overall sediment load. A standard P absorption procedure was proposed and the ability of four laboratories to produce consistent results over a wide range of soils was determined. Soil (0.5 or 1.0 g) was shaken in 0.01 mol/1 CaCl2 at a soil-solution ratio of 1:25 in containers allowing a 50% head space for 24 hours at 24 to 26 degrees C on an end-over-end shaker. Initial dissolved inorganic P concentrations of 0 to 323 micronmol PL/1 as (KH2PO4 or NaH2PO4) were used and microbial activity inhibited by 20 g/l chloroform. Excellent agreement between the four laboratories was obtained for P absorbed by the 12 soils studied, with a mean coefficient of variation over all P levels and soils of 0.91%. The laboratories also exhibited a high degree of replication of individual treatments with no laboratory showing a strong consistent bias across all soils and P levels in terms of P adsorption. The proposed method has the potential to produce consistent results which can be used to predict partitioning of dissolved inorganic P between soild and solution phases.

W85-01794

ACCUMULATION OF THE TRACE ELE-MENTS LEAD AND ZINC BY ASELLUS COM-MUNIS AT THREE DIFFERENT PH LEVELS,

MUNIS AT THREE DIFFERENT PH LEVELS, Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
T. Lewis, and A. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202514, Price codes: A03 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 21 p, 19 Fig, 15 Tab, 17 Ref. Project No. OWRT A-068-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Heavy metals, *Zinc, *Lead, *Sediments, *Bioaccumulation, *Hydrogen ion concentration, Isopods, Asellus communis, Trace ele-

The freshwater isopod Asellus communis was exposed to lead (Pb) and zinc (Zn) contaminated sediments at three different pH levels: 7.6, 5.5 and 4.5. Significant releases of trace elements occurred at pH 4.5 (Pb and Zn) and pH 5.5 (Zn only). Patterns of accumulation of the two trace elements by Asellus differed dramatically; there was little accumulation of Zn at any pH level, while significant increase in Ph concentrations were noted at cant increases in Pb concentrations were noted at the two lower pH levels. Both water and sediment appeared capable of acting as significant sources of Pb for the organisms.

FLUXES OF HEAVY METALS IN DELAWARE RIVER PRESHWATER TIDAL WETLANDS, Rider Coll., Lawrenceville, NJ. Dept. of Biology. R. L. Simpsom, R. E. Good, B. J. Dubinski, J. J. Pasquale, and K. R. Philipp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190057, Price codes: A05 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, Rutgers Univ., New Brunswick, NJ, December, 1983. 79 p. 22 Fig. 22 Tab, 54 Ref., 1 Append. Project No. OWRT A-060-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: "Tidal marshes, "Marsh plants, "Litter, Aquatic soils, Cadmium, Copper, Lead, Nickel, Zinc, Activated sludge, Water pollution control, "Heavy metals, "Wetlands, "New Jersey, Woodbury Creek Marsh, Freshwater tidal wetlands, "Delaware River, Allocation patterns, Heavy metal retention.

A survey of ten wetlands showed soil heavy metals A survey of ten wetlands showed soil heavy metals were generally lowest in rural areas and highest in urbanized and industrialized areas. Cr, Cu, and Cd levels were highest at transects nearest the Delaware River while Ni and Pb were highest near the tidal boundary indicating a differential importance of riverine and upstream inputs to these wetlands. Regression analysis showed significant (P < or = .05) positive relationships between % sit and Cr, Cd, Ni, and Pb. The high marsh through sites with

the highest % silt likewise had the highest metal concentrations. Extensive studies at Woodbury Creek Marsh showed little seasonal pattern in soil metal concentrations, but distinct concentration gradients with depth and distance from a storm drain discharging nonpoint source runoff. The vegetation, while accumulating metals especially below ground, had much lower metal levels than the soil although the pattern of accumulation, Zo > Pb > Cu nearly = Ni > Cd, closely paralleled soil metal levels. Litter was enriched up to 20-fold as it decomposed with Cd and Ni levels reaching ambient soil levels while Cu and Pb were half to two-thirds those in the soil. Except for increases in Cr, the vegetation did not respond to the application of sewage sludge enriched with heavy metals. The soils of the high treatment sites (100 g/sq m/wk sludge) retained Cd (43%), Cr (53%), Cu (52%), Pb (31%), and Zn (51%) in the sludge at the end of the application period in October, but only Cd (15%) and Cr (12%) were still present the following March. The soils of the low treatment sites (25 g/sq m/wk sludge) retained only Cd (43%) and Cr (28%) in October, but these metals remained in the soil at the same level through the next March. Delaware River freshwater tidal wetlands have the capacity to sequester additional metals but at a slow rate. Direct sedimentation and lands have the capacity to sequester additional metals, but at a slow rate. Direct sedimentation and the litter are the major pathways for a long-term accumulation of heavy metals in these wetlands. W85-01805

CHEMICAL STUDY OF THE INTERSTITIAL WATER DISSOLVED ORGANIC MATTER AND GASES IN LAKE ERIE, CLEVELAND HARBOR, AND HAMILTON HARBOUR BOTTOM SEDIMENTS—COMPOSITION AND FLUXES TO OVERLYING WATERS, Wright State Univ., Dayton, OH. Brehm Lab. D. D. Adams, G. G. Hess, N. J. Fendinger, D. A. Deis, and D. J. Wagel. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195783, Price codes: A09 in paper copy, A01 in microfiche. Ohio Water Resources Center, Ohio State Univ., Columbus, Report No. 712433, (1984). 187 p., 36 Fig. 32 Tab, 248 Ref, 1 Append. Project No. OWRT A-059-OHIO(1).

Descriptors: *Sediments, *Interstitial gases, Dissolved organic carbon, Methane, Nitrogen, Carbon dioxide, SOD chambers, *Lake Erie basins, Cleveland Harbor, Hamilton Harbour, *Dissolved organic compounds, Sediment porosity, Volatile solids, *Ohio, Water quality, Water pollution sources, Chemical analysis.

During 14 cruises in 1979 and 1980 SCUBA-collected sediment cores were obtained from the three basins of Lake Erie, Cleveland Harbor and Hamilton Harbour for determining interstitial water dissolved organic carbon (DOC) and dissolved gases (methane, nitrogen and total carbon dioxide). Sediments were also measured for volatile solids and water content, while EPA organic priority pollutants (purgeable, base/neutral and acid extractable) and molecular size ranges of dissolved organic matter (DOM) were evaluated in selected interstitial water samples. Because of high sediment concentrations, calculated diffusive losses of CH4 and sigma CO2 approximated 2-16% of the C influx to open lake sediments while 13-44% of the N sedimentation could be lost by denirified N2 gas production. Diffusion of CH4 could account for up to 30% of the sediment oxygen demand. N2 gas was supersaturated in numerous interstitial water samples Celifated interstition. supersaturated in numerous interstitial water sam-ples. Sediment interstitial water DOC ranged from pies. sediment interstitial water DOC ranged from an average of 6 mg/L in Lake Eric's central basin to 91 mg/L in Hamilton Harbour. DOM in open lake sediments consisted of high (> 20,000) molecular weight substances with few compounds indentified by GC/MS. A greater percentage of Hamilton Harbour DOM was less than 20,000 molecular in the base of the control of the weight with heterocyclic, aromatic and polynu-clear (or unidentified and unresolved) type comctear (or unidentified and unresolved) type com-pounds suggestive of anthropogenic sources; some were identified as potentially hazardous. A signifi-cant linear relationship existed between DOC and CH4 in open lake and Cleveland Harbor sediments; this was not the case for Hamilton Harbour sug-gesting complex substances not decomposed by methanogens.

EFFECT OF VARIOUS HYDROLOGIC PARAMETERS ON THE QUALITY OF STORMWATER RUNOFF FROM A WEST LAFAYETTE, INDIANA URBAN WATERSHED,

Purdue Univ., Lafayette, IN. Dept. of Environ-

Purdue Univ., Lafayette, IN. Dept. of Environ-mental Engineering.
M. S. Blumberg, and J. M. Bell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207380, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center Technical Report No. 162, January 1984. 121 p, 26 Fig. 19 Tab, 44 Ref, 2 Append. Project No. OWRT C-00090-U-IND(2), Contract/Grant No. 14-34-0001-

Descriptors: *Wastewater effluents, Wastewater treatment, *Stormwater runoff, Water quality, Regression analysis, *Indiana, *Urban watershed,

Increasingly stringent quality standards for wastewater effluents, and increased efficiency of wastewater treatment plant operations, have made the pollution due to stormwater runoff more obvious. This study investigated the quality of stormwater runoff from a 29 acre, fully developed, residential watershed. The importance of various hydrologic activities (average intensity of rainful dential watershed. The importance of various ny-drologic activities (average intensity of rainfall, peak intensity of rainfall, total rainfall, peak rate of runoff, total runoff, and duration of precipitation event) on stormwater pollutant concentrations, total mass (or number), and peak rates was evaluat-ed by multiple regression analyses. One has 99% confidence in the regression models developed for total mass (or number) and neak rate of all pollut-total mass (or number) and neak rate of all polluttotal mass (or number) and peak rate of all pollut-ants studied, and 97% confidence in the models ants studied, and 97% confidence in the models developed for average and peak concentrations of total coliforms. The hydrologic activities accounted for 33-87% of the variance in the pollutant data. Several postulated relationships were examined using data collected during this study. No relationship was apparent between the quantity of previous rainfall or the length of the antecedent dry period and the quality of stormwater runoff. Neither was an overall trend apparent between the time elapsed since street cleaning and the quality of stormwater runoff. stormwater W85-01822

POTENTIAL FOR ACIDIFICATION OF SIX REMOTE PONDS IN THE WHITE MOUNTAINS OF NEW HAMPHIRE,

Northeastern Forest Experiment Station, Durham, NH

D. C. Buso, C. W. Martin, and J. W. Hornbeck. D. C. Buso, C. W. Martin, and J. W. Hornbeck. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-207349, Price codes: A08 in paper copy, A01 in microfichewater Resource Research Center Research Report No. 43, Univ. of New Hampshire, Durham, February, 1984. 157 p, 60 Fig. 71 Tab, 59 Ref, 2 Append. Project No. OWRT A-060-NH(1), Contract No. 14-34-0001-2131.

Descriptors: *Alkalinity, Sulfate, Aluminum, *Acid rain, *Acid precipitation, *Acidification, Ponds, White Mountains, *New Hampshire, Pond chemistry, Hydrogen ion concentration

Six remote ponds and their watersheds in the White Mountains of New Hampshire were mapped, and chemical characteristics of the ponds and inlet streams were measured to estimate susceptibility to acid precipitation. The methods used and data collected during 1980-82 are included for possible comparisons with future studies or for alternative analyses and interpretations. Although the ponds are within a 20 km radius of each other and seemingly have similar watershed characteristhe ponds are within a 20 km radius of each other and seemingly have similar watershed characteristics and precipitation chemistry, the volume-weighted pH between ponds ranged from 4.5 to 6.4. Volume-weighted alkalimity ranged from 0 to 144 micro-eq/l. Alkalimity was related to pH, basin morphology, production of hypolimentic alkalimity, and chemistry of inlet streams. Historic pH and alkalimity data from these ponds are inadequate for determining if they are acidifying. Volume-weighted S04(2-) ranged from 70 to 170 micro-eq/l among the ponds. The ratios of divalent cations countering S04(2-) suggest that weathering within

Sources Of Pollution-Group 5B

the watersheds of the various ponds is an important factor in buffering acid precipitation and pond acidity. Volume-weighted total aluminum ranged from 0.10 to 0.60 mg/l. The most acidic ponds had the most total aluminum. The less acidic ponds appear to produce enough alkalinity and dissolved organic carbon to allow complexing of inorganic, toxic forms of aluminum. All ponds experienced short-term acidification in the upper water as a result of snowmelt events. Four models for predicting the susceptibility of the six study ponds to acidification worked poorly. Each of the six ponds is unique and a broad approach at grouping them based only on one or two parameters is inadequate. W85-01834

RIVER ELBE: PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCH-LORINES DURING ESTUARINE MIXING, Nederlands Inst. voor Onderzoek der Zee, Texel. J. C. Duinker, M. T. J. Hillebrand, R. F. Nolting,

and S. Wellershaus. Netherlands Journal of Sea Research, Vol. 15, No. 2, p 141-169, July, 1982. 20 Fig. 1 Tab, 26 Ref.

Descriptors: *Elbe Estuary, *Fate of pollutants, *Path of pollutants, *Metals, *Polychlorinated biphenyls, Estuarine environment, Sedimentation, Erosion, Resuspension, Suspended solids, Dissolved solids, Particulate matter.

The Elbe Estuary is a coastal plain estuary. It debouches into the North Sea (Wadden Sea) near Cuxhaven, with the mouth being bordered by tidal flats. Attempts were made to determine the relative importance of chemical or physico-chemical processes, and sedimentation and resuspension processes on the behavior of metals (Cd, Zn, Cu, Pb, Cr, Mn, Fe, Ca, Al, Si, Ti, Mg), organic C and N and organochlorine compounds in the estuarine region of the River Elbe in summer 1976. Sedimentation and resuspension seemed to be relatively less tation and resuspension seemed to be relatively less important than in some other estuaries. This may important than in some other estuaries. This may result from a much less pronounced mud shoal in the Elbe estuary. Alternating sedimentation and erosion resulted in systematic variations in the composition of suspended matter in terms of the relative contributions of two fractions: permanently suspended small and low-density particles having higher contents (w/w) of Cd, Zn, Pb, Mg and organic C and N; and resuspended larger and denser (mud) particles having higher contents of Mn, Fe, Al, Si and Ti. In addition to Al silicates, organic matter and Fe and Mn oxides may be organic matter and Fe and Mn oxides may be deuter (mud) particles having higher contents of Mn, Fe, Al, Si and Ti. In addition to Al silicates, organic matter and Fe and Mn oxides may be important sites for trace elements in both fractions, but particularly so in the permanently suspended fraction. Cd, Zn, Cu, Mn and Fe may have been removed from solution into suspended particles during the initial phases of estuarine mixing. Estuarine mud, acting as sink for particulate pollutarismay accumulate originally dissolved components. A wide range of PCB components with high and low degrees of chlorination was present in solution as well as in suspension. Water was the most important carrier for components with a low degree of chlorination, and seston for components with a high degree of chlorination. Concentrations of individual PCB components ranged from picograms to nanograms per liter. (Moore-IVI)

RIVER WESER PROCESSES AFFECTING THE BEHAVIOUR OF METALS AND ORGANOCH-LORINES DURING ESTUARINE MIXING,

Nederlands Inst. voor Onderzoek der Zee, Texel. J. C. Duinker, M. T. J. Hillebrand, and R. F.

Nolting. Netherlands Journal of Sea Research, Vol. 15, No. 2, p 170-195, July, 1982. 16 Fig. 1 Tab, 16 Ref.

Descriptors: *Estuaries, *Metals, *Fate of pollutants, *River Weser, Mixing, Chlorinated hydrocar-bons, Particulates, Resuspension, Dissolved solids, Organic compounds, Polychlorinated biphenyls.

Measurements of dissolved and particulate susmeasurements of dissolved and particulate sus-pended metals and organochlorine compounds were made along with studies on hydrographic and sedimentation-resuspension processes in the fresh water and the estuarine mixing zone of the tidal river Weser during typical spring tide condi-

tions. The position of the mixing zone was 20 km upstream of its normal position as a result of the extremely low river discharge in the dry summer of 1976. Concentrations of Cd, Zn, Cu Pb, Mn, and Fe in solution in the mixing zone increased by contributions from interstitially dissolved components during resuspension of bottom sediments. Variations in the contents of metals in seston is interpreted in terms of varying contributions of different fractions that had different sedimentation and resuspension characteristics as well as different chemical composition. A wide range of PCB components with high and low degree of chlorination was present in solution and in suspension. Suspended particles were the most important carriers for components with higher degrees of chlorination. Concentrations of individual PCB components in fresh water varied between a few picograms per litre and the nanogram per litre range. The only compounds present in the estuary and the Wadden Sea above the detection limit in 1 liter samples were alpha- and gamma-hexachlorocyclohexane in the low and sub ng/liter range. (Baker-IVI)

ONE-DIMENSIONAL MIXING AND FLUSH-ING MODEL OF THE EMS-DOLLARD ESTU-ARY: CALCULATION OF TIME SCALES AT DIFFERENT RIVER DISCHARGES, Nederlands Inst. voor Onderzoek der Zee, Texel. For primary bibliographic entry see Field 2L. W85-01838

USE OF A MODEL TO ASSESS FACTORS AF-FECTING THE OXYGEN BALANCE IN THE WATER OF THE DOLLARD, Biologisch Centrum, Haren (Netherlands). For primary bibliographic entry see Field 2L. W85-01839

BEHAVIOUR OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE EXE ESTUARY,

DEVON, Bayreuth Univ. (Germany, F.R.). Lehrstuhl fuer

Hydrologie. R. Herrmann, and D. Hubner. Netherlands Journal of Sea Research, Vol. 15, No. 3/4, p 362-390, December, 1982. 18 Fig, 3 Tab, 50 Ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Estuaries, *Sediments, *Runoff, Fate of pollutants, Path of pollutants, Model studies, Hydrocarbons, Suspended sediments.

Polycyclic aromatic hydrocarbon (PAH) pollution resulting from river runoff to a receiving estuary is associated with suspended sediments. This is due to the high sorption coefficients on suspended and bottom sediments. Thus, the highest concentrations of PAH are found along the tidal channel within the mixing zone. The regional and temporal variation of suspended PAH, which was measured at 4 anchor stations during complete tidal cycles and at 4 traverses along the main tidal channel, is characterized by an increase of suspended PAH concentration and net positive fluxes from the river into the mixing zone and a subsequent decrease toward the sea. In the upper water column higher concentrations per weight of suspended sediment have been observed than in the lower one. This may be explained by a greater adsorption coefficient of the upper fine suspended sediments and a dilution by landward transport of marine suspended sediments near the bottom. A lab experiment involving short term (2 hrs) interaction of suspended PAH with increasing salimities did not show significant removal of PAH from suspension. In a long term (a few hours) interaction, the importance of sea water electrolytes for the removal of suspended PAH could be proved. The connection between regional distribution of suspended PAH and estuarine circulation was demonstrated by a two-dimensional box model. (Baker-IVI) Polycyclic aromatic hydrocarbon (PAH) pollution

KEPONE CONCENTRATION IN JUVENILE ANADROMOUS FISHES, Virginia Inst. of Marine Science, Gloucester Point. J. G. Loesch, R. J. Huggett, and E. J. Foell.

Estuaries, Vol. 5, No. 3, p. 175-181, September, 1982. 1 Fig, 3 Tab, 25 Ref.

Descriptors: *Kepone, *Fish, *Potomac River, *Rappahannock River, *Pamunkey River, *Matta-poni River, *Chickahominy River, *James River, *Virginia, Alewife, Shad, Herring, Bass, Pesti-cides, Path of pollutants, Aeolian contamination.

The James River was closed to all forms of fishing in December 1975 as a result of Kepone contamination. The ban was later modified to allow fishing for American shad, alewife, blueback herring, and catfishes. Young-of-the year alewife, American shad, blueback herring, and striped bass were analyzed for Kepone contamination. Samples were collected from the Potomac. Raponhannock. Pacullected from the Potomac. Raponhannock. lyzed for Kepone contamination. Samples were collected from the Potomac, Rappahannock, Pamunkey, Mattaponi, Chickahominy, and James rivers during the period 1977-79. Concentrations of Kepone > or = 0.03 ppm occurred in all four species collected in the James River nursery zone between km 65 and 120, and in the lower Chickahominy River. Kepone was not detectable in samples from the Rappahannock and Potomac rivers. Concentrations of Kepone < 0.3 ppm were also present in samples from the Mattaponi and Pamunkey rivers. Possible explanations for the occurrence of Kepone in these samples from the upper York River system (Mattaponi and Pamunkey rivers) include: sample contamination or misidentification; migration of adults to the York River; migration of adults to the York River; migration of adults to the York River system from the James River; migration and River after contamination system from the James River after contamination but prior to spawning; and aeolian contamination of the upper York river watershed due to its juxtaposition to the James River. Aeolian transport is believed to be most likely. (Moore-IVI) W85-01847

TIDAL AND SEASONAL VARIATIONS OF SULFATE ION IN A NEW JERSEY MARSH

Kean Coll. of New Jersey, Union. Dept. of Chemistry-Physics.

G. W. Luther, III, A. L. Meyerson, K. Rogers, and F. Hall.

Estuaries, Vol. 5, No. 3, p 189-196, September, 1982. 5 Fig, 1 Tab, 31 Ref. NOAA grants 04-6-158-44042 and 04-7-158-44-042.

Descriptors: *Piles Creek Marsh, *New Jersey, Descriptors: Fries Creek washing, Two States), 'Sulfates, 'Tidal effects, 'Seasonal variation, Estu-arine environment, Chlorides, Water temperature, Dissolved oxygen, Hydrogen ion concentration, Rainfall, Productivity, Metals, Fate of pollutants.

In order to investigate possible sulfate reactions in a polluted system, Piles Creek Marsh off Newark Bay in New Jersey was chosen as a study site. The entire estuarine system is surrounded by highly industrialized areas and has become highly pollutindustrialized areas and has become highly pollutional collections of the collection of sulfate ion of audition of sulfate ion of sulfate ion of sulfate ion concentration is not conservative in the tidal marsh system. As high tide waters flow through the sediment, sulfate reduction occurs. This reduction process will produce a sulfide species capable tion process will produce a sulfide species capable of precipitating many metal ions, especially in highly polluted environments. At low tide waters, sulfide minerals in creek sediments may be only sulfide minerals in creek sediments may be oxi-dized during high pH and dissolved oxygen events such as biological productivity. In Piles Creek Marsh, the large differences in the magnitude of Marsii, the lange differences in the magnitude of the oxidation and reduction processes might cause a net export of sulfate ion from the marsh to the Arthur Kill. Such an export of sulfate ion might also cause a mobilization of metals which had precipitated as sulfides. (Moore-IVI) W85-01848

ORIGIN OF NITRATES IN GROUNDWATER OF THE BUNZ VALLEY (WOHER STAMMEN

Group 5B—Sources Of Pollution

DIE NITRATE IM GRUNWASSER DES BUNZ-

Kanton Aargau, Aarau (Switzerland). Informations- und Dokumentations-dienst. W. Fricker.

Wasser, Energie, Luft, Vol. 75, No. 3, p 75-77, 1983.

Descriptors: *Groundwater pollution, *Nitrates, *Bunz valley, *Switzerland, Water pollution sources, Animal wastes, Fertilizers, Sludge dispos-al, Water pollution control, Water treatment.

A study was ordered in 1975 to determ origins of nitrates in the groundwater of the Bunz valley, Aargau Canton, Switzerland. This followed the discovery of increasing nitrate concentrations Valley, Aargau Canton, Switzerland. Institutions the discovery of increasing nitrate concentrations in groundwater wells in the region between 1970 and 1975, occasionally exceeding the Swiss manimum permissible level of 40 mg/l. The Bunz valley covers 8,600 ha, of which 53% is used agriculturalcovers 8,000 na, or which 33% is used agricultural ly. The main source of nitrate was the agricultural application of nitrogen to the soil, which totals about 430 kg/yr. Half of this is applied a direct manuring (73.8% farmyard manure, 23.8% mineral fertilizer and 2.4% sludge from wastewater treat-ment plants). About 2.3% of this appears in runoff ment plants). About 2.3% of this appears in runoff as nitrate. Increased nitrate concentrations can be expected when a large proportion of land is fallow, when fallow land is fertilized with nitrogen at times other than the growing season, ard when fertilization is performed at the incorrect time. Short-term measures to combat this are to educate farmers in correct fertilization and planting practices, to institute fertilization restrictions in ground water conservation ages, and to reduce nitrates in tices, to institute tertilization restrictions in ground water conservation areas, and to reduce nitrates in drinking water by ion exchange or reverse osmosis. Intermediate measures are to dilute nitrate-rich wells with water from nearby wells with low nitrate levels and to cultivate only those crops from the property of the control o (grass alone in extreme cases) that prevent excessive runoff of nitrates. (Gish-IVI) W85-01856

HEAVY METAL MIGRATION IN SOIL-LEACHATE SYSTEMS, Miami Univ., Coral Gables, FL. Dept. of Mechani-Maint Only, Cora Caulos, P.L. Dept. of mechanical Engineering.
K. V. Wong, S. Sengupta, D. Dasgupta, E. L.
Daly, Jr., and N. Nemerow.
BioCycle, Vol. 24, No. 1, p 30-33, January/February, 1983. 3 Fig. 8 Tab, 10 Ref.

Descriptors: *Heavy metals, *Soil properties, *Mi-gration, *Permeability, Groundwater pollution, Mathematical model, Leachates.

Prediction of heavy metal migration in soil-leach-ate systems requires an understanding of the vari-ous mechanisms governing the behavior of the soil and the leachate. Four specific soils from Pomano Beach, Florida were studied: Hallandale fine sand, Beach, Florida were studied: Hallandale fine sand, Plantation muck top layer, Plantation muck middle layer, and Plantation muck bottom layer. The first two are sandy in nature while the last two are clayey. Experiments were conducted to determine the manner in which the cations distributed themselves between the characteristic liquid and the four types of soil studied in the present work. The distribution coefficients of eight cations (Cu, Fe, Mn, Ni CA) cr. Ca, Tall between a complex mix. distribution coefficients of eight cations (Cu, Fe, Mn, Ni, Cd, Cr, Ca, Za) between a complex mixture and the four soil types were determined. The Lapidus-Amundson model and the Langmuir model were used to predict the migration of the heavy metal ions in soil-leachate systems. The relative mobilities of the eight cations have been quantitatively measured in terms of the length of time taken by each cation to reach steady state under a fixed set of initial and boundary conditions. The relative mobility of a cation in the mixture as predicted by the Lapidus-Amundson model is different from that predicted by the Langmuir model. (Baker-IVI) (Baker-IVI) W85-01868

UPTAKE OF KEPONE FROM SEDIMENT SUS-PENSIONS AND SUBSEQUENT LOSS BY THE OYSTER CRASSOSTREA VIRGINIA,

OYSTER CRASSOSIREA VIRGINIA, Virginia Inst. of Marine Science, Gloucester Point. R. Morales-Alamo, and D. S. Haven. Marine Biology, Vol. 74, No. 2, p 187-201, 1983. 11 Fig. 3 Tab, 59 Ref. EPA grant R804993010.

Descriptors: *Kepone, *Oysters, *Suspended sediments, *James River, *Virginia, Path of pollutants, Sediment contamination, Pesticides, Bioaccumulation, Concentration factor.

Oysters in laboratory trays received sediment suspensions prepared with sediments contaminated with Kepone from the James River, Virginia, USA. Oysters in trays were also exposed to water pumped directly out of two tributary creeks of the James River. Oysters took up Kepone from the sediment suspensions very rapidly and the steady state in uptake appeared to be attained within one week. Loss of Kepone by oysters was also rapid. An average of 70% (95% confidence interval = 51-90%) of the Kepone in their tissues was eliminated during the first week, but a small residue was still present in the oysters after four weeks. The computed biological half-life of Kepone in oysters ranged between 3 and 10 d, with a mean of 5.2 d. Computation of concentration factors in the tissues ranged between 3 and 10 4, with a mean or 3.2 d. Computation of concentration factors in the tissues of the experimental oysters included the volume of water in which the sediment particles were suspended. Concentration factors in laboratory experiments ranged from 574 to 4 167 and in field experiments from 28 000 to 36 000. Concentration experiments from 28 000 to 56 000. Concentration factors were inversely related to concentrations in the sediment suspensions. It is suggested that this relationship may have resulted from interference of uptake by increasing concentrations of suspended matter or from a significant uptake of Kepone from solution. It is also suggested that Kepone available to oysters in solution may be of a magnitude similar to that available from sediments in suspension when the density of those sediments in the water is taken into consideration. (Author's abstract) W85-01897

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: II APPLICATION TO ARSENIC IN PROFILES: II APPLICATION TO ARSENIC IN THE TAMAR ESTUARY (S.W. ENGLAND), Marine Biological Association of the United King-dom, Plymouth (England), S. Knox, W. J. Langston, M. Whitfield, D. R. Turner, and M. I. Liddicoat. Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 623-638, June, 1984. 6 Fig. 5 Tab, 28 Ref.

Descriptors: *Tamar Estuary, *England, *Arsenic, *Estuaries, Statistical analysis, Sediments, Interstitial water, Manganese, Fate of pollutants, Iron oxyhydroxide, Oxidation.

By combining field observations with a statistical approach and a simple but effective estuarine analogue, the main features of the cycling of arsenic in the Tamar estuary have been elucidated. As(III) and As(V) enrichment in the water column is due to a combination of localized inputs and effective recycling of sediment interstitial waters. The profiles of As(V) are similar to those of NH4(+) and are dominated by an estuarine maximum resulting from an input from the sediments. As(III) profiles are correlated with those of dissolved manganese and exhibit both fresh water and estuarine maxima. As(III) appears to be effectively removed at the freshwater/brackish water interface by a combination of heterogenous oxidation, catalyzed by hydrous manganese dioxide, and adsorption on to iron oxyhydroxide. The estuarine distribution of As(III) within the water column is consistent with As(III) within the water column is consistent with the published rates of oxidation of As(III) to As(V) AS(III) within the published rates of oxidation of As(III) to As(V) by both inorganic and microbiological processes. The reduction of As(V) to As(III) in the sediments is incomplete. On the basis of the observations a tentative estuarine arsenic cycle is presented. (Author) about the processes. thor's abstract) W85-01914

HYDROCARBONS IN WASHINGTON COAST-AL SEDIMENTS, Washington Univ., Seattle. School of Oceanogra-

phy.
F. G. Prahl, and R. Carpenter.
Estuarine, Coastal and Shelf Science, Vol. 18, No. 6, p 703-720, June, 1984. 4 Fig. 4 Tab, 45 Ref.
DOE contracts EY76-S-06-0225-TA40 and EY76-

Descriptors: *Hydrocarbons, *Sediments, *Washington, *Coastal waters, Aliphatic hydrocarbons,

Polycyclic aromatic hydrocarbons, Fate of pollutants, Particulates.

The sources and distributions of polycylic aromatic hydrocarbons (PAH) and aliphatic hydrocarbons are characterized in seventeen sediments from a highly river-influenced sedimentary environment off the southwestern coast of Washington. The major hydrocarbons are land-derived, introduced as preformed compounds and display long-term stability in sediment cores. A series of PAH of anthropogenic origin and two naturally derived compounds, retene and perylene, dominate the PAH composition in these sediments. Plantwax nalkanes are the major aliphatic hydrocarbon constituents. Aliphatic hydrocarbons of marine origin, pristane and a series of four acyclic, mutibranched (25 no)ledfins are also observed in many sedistituents. Aliphatic hydrocarbons of marine origin, pristane and a series of four acyclic, multibranched C25 polyolefins, are also observed in many sediments. The concentrations of these marine-derived hydrocarbons decrease to negligible levels rapidly with sediment depth from the sea-sediment interface, suggesting degradation. In general, the major land-derived hydrocarbons are concentrated in the mid-shelf, edit, deposit, which sextends north. land-derived hydrocarbons are concentrated in the mid-shelf silt deposit which extends north-westward along the continental shelf from the Columbia River mouth. A quantitatively more minor, natural series of phenanthrene homologs, also of terrestrial origin, is preferentially advected further offshore and deposited in continental slope sediments. These distributions are consistent with recognized particle, associations for these comrecognized particle associations for these com-pounds and sediment dispersal processes in this coastal environment. Sediment core records sug-gest the present pattern of dispersal has persisted for at least the past century and possibly since the Late Pleistocene. (Author's abstract) W85-01915

SHORT-TERM CHANGES IN THE BASE NEU-TRALIZING CAPACITY OF AN ACID ADI-RONDACK LAKE, NEW YORK,

Syracuse Univ., NY. Dept. of Civil Engineering. C. T. Driscoll, and G. C. Schafran. Nature, Vol. 310, No. 5795, p 308-310, July, 1984. 2 Fig, 2 Tab, 29 Ref.

Descriptors: *Acid lakes, *Base neutralizing capacity, *Acid rain, *Dart Lake, *New York, Aluminum, Nitrates, Carbonates, Sulfates, Hydrogen ion concentration, Snowmelt, Acidification, Atmospheric deposition.

The source of base neutralizing capacity (BNC) within acid surface waters has been attributed to atmospheric deposition of H2SO4 (or SO2) or HNO3, as well as production of soluble organic acids from soils. Aluminum is often a very significant component of BNC in acidic waters. Shorter changes in the BNC of Dart Lake, an acidic clearwater lake, were evaluated. Samples were collected for water quality analysis at the inlet, outlet and at seven depths, approximately evey two weeks over an annual cycle. Although H2CO3 was the major component of BNC in Dart Lake, levels of hydrogen ion and aluminum BNC in acid lakes of hydrogen ion and aluminum BNC in acid lakes are generally of more interest because of potential toxicity to organisms. Much of the variation in hydrogen ion and aluminum BNC can be attributed to changes in nitrate concentration, rather than to variations in sulfate, chloride, or organic anion concentrations. Sulfate is usually the domi-nant anion in Adirondack surface waters and in nant anion in Adirondack surface waters and in atmopheric inputs to the region. Additions of NO3(-) during snowmelt and depletions of NO3(-) associated with assimilation and reduction processes appear to be very inportant in regulating short-term changes in hydrogen ion and aluminum concentrations. (Moore-IVI) W85-01917

EFFECTS OF CHANNEL EXCAVATION ON WATER-QUALITY CHARACTERISTICS OF THE BLACK RIVER AND ON GROUND-WATER LEVELS NEAR DUNN, NORTH CAROLINA,

Geological Survey, Raleigh, NC. Water Resources

For primary bibliographic entry see Field 2A.

Sources Of Pollution-Group 5B

GROUND-WATER HYDROLOGY AND QUAL-ITY BEFORE AND AFFER STRIP MINING OF A SMALL WATERSHED IN JEFFERSON COUNTY, OHIO, Geological Survey, Columbus, OH. Water Re-sources Div.

For primary bibliographic entry see Field 4C. W85-01943

HYDROGEOLOGY AND WATER QUALITY OF SIX LANDFILL SITES IN HILLSBOR-OUGH COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

Geological Survey, Fallanassee, F.L. water Re-sources Div. A. D. Duerr, and M. Fernandez, Jr. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4810, 1983. 112 p, 52 Fig, 19 Tab, 55 Ref.

Descriptors: *Solid-waste disposal, *Landfills, *Groundwater movement, *Groundwater pollution, *Karst hydrology, *Florida, Hillsborough County.

A hydrogeologic study of six landfills in Hillsborough County, Florida, showed that refuse was deposited in trenches constructed in the upper part of the surficial aquifer. Use of the trench method resulted in increased decomposition of refuse in water and accelerated degradation of water in the surficial aquifer because as much as 50 percent of the refuse was deposited in the saturated zone. Use of oxidation ponds to store water pumped from trenches that contained refuse, and refuse and debris that collected in perimeter ditches, affected the quality of water in the surficial aquifer. The trench method of landfilling has restricted use in Hillsborough County and other areas of Florida where high water levels occur. The potential for degradation of water in the surficial and Floridan aquifers may increase after a landfill is closed because maintenance generally is discontinued. Concause maintenance generally is discontinued. Continued monitoring of surface- and ground-water sites would help to assess the long-term movement of leachate from a landfill and its effect on water quality. (USGS) W85-01946

APPLICATION OF REMOTE-SENSING TECH-NIQUES TO HYDROLOGIC STUDIES IN SE-LECTED COAL-MINED AREAS OF SOUTH-EASTERN KANSAS,
Geological Survey, Lawrence, KS. Water Re-

sources Div.

Sources Liv.

J. F. Kenny, and J. R. McCauley.

Available from OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4007, 1983. 33 p, 10 Fig, 3

Tab, 19 Ref.

Descriptors: *Acid mine drainage, *Subsidence, *Erosion, Mine wastes, *Remote sensing, *Reclamation, *Revegetation, Aerial photography, *Water quality, Coal mines, Cherry Creek,

Disturbances resulting from intensive coal mining in the Cherry Creek basin of southeastern Kansas were investigated using color and color-infrared aerial photography in conjunction with water-quality data from simultaneously acquired samples. Imagery was used to identify the type and extent of vegetative cover on strip-mined lands and the extent and success of reclamation practices. Drainage patterns, point sources of acid mine drainage, and recharge areas for underground mines were located for onsite inspection. Comparison of these interpretations with water-quality data illustrated differences between the eastern and western parts of the Cherry Creek basin. Contamination in the eastern part is due largely to circulation of water from unreclaimed strip mines and collapse features from unreclaimed strip mines and collapse features through the network of underground mines and subsequent discharge of acidic drainage through seeps. Contamination in the western part is primarseeps. Contamination in the western part is primar-ily caused by runoff and seepage from strip-mined lands in which surfaces have frequently been graded and limed but are generally devoid of mature stands of soil-anchoring vegetation. The successful use of aerial photography in the study of

Cherry Creek basin indicates the potential of using remote-sensing techniques in studies of other coalmined regions. (USGS) W85-01947

INTEGRATED METHODOLOGY FOR INSTREAM FLOW STRATEGIES,

Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering. M. A. Medina, Jr.

Water Resources Research Institute Completion Report, North Carolina State Univ., Raleigh, Sep-tember, 1983. 142 p, 91 Fig, 19 Tab, 79 Ref.

Descriptors: Flow control, Stream fisheries, Streamflow, *Pollution load, Water quality, *Instream flow, Model studies, *Computer models, Simulation, *Computer programs, *North Carolina, Salem Creek, Path of pollutants, Water pollution sources, *Microcomputer programs.

An integrated methodology for instream flow strategies is presented, based on hierarchical package of computer models ranging from simple microcomputer programs to more complex mainframe simulation. The microcomputer programs are statistically based, and assume that both flows and pollutant concentrations are lognormally distributed for upstream sources, non-point sources and point sources. An extensive statistical analysis of nationwide data collected under the National Urban Runoff Program (NURP), as well as at the study site for the selected time series (Salem Creek, Winston-Salem, N.C.-November 1980 to August 1981), supports this assumption. The level of analysis progresses to an intermediate level: steady-state, continuous deterministic simulation. This level allows the representation of cause/effect (pollutant/water quality), coupled reactions.

FATE OF EPSILON-CAPROLACTAM IN THE AQUATIC ENVIRONMENT,

Syracuse Research Corp., NY. L. Fortmann, and A. Rosenberg. Chemosphere, Vol. 13, No. 1, p 53-65, 1984. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Fate of pollutants, *Degradation, *Caprolactam, Organic compounds, Temperature effects, *Nutrients, *Microorganisms, Industrial

The rate and extent of caprolactam degradation in aquatic systems are dependent on the nutrient availability, indigenous microbial population and activity, chemical concentration, and water temperature. The labeled chemical evolved C-14 labeled CO2 indicating ring cleavage with between 55 and 80% of the radioactivity evolved as C-14 carbon dioxide after 21 days in yeast extract-supplemented waters. The percent of caprolactam degraded was indirectly related to the concentration in the water, suggesting microbial inhibition at high caprolactam concentrations. The addition of yeast extract or sediment to water significantly enhanced the rate and extent of caprolactam degradation. Most likely yeast extract acted by increasenhanced the rate and extent of caprolactam degra-dation. Most likely yeast extract acted by increas-ing the numbers of microorganisms capable of degrading the chemical. The influence of sediment may have been due to the possibility that in the sediment there is a much greater inoculum of ca-prolactam degrading microorganisms than in the lake or stream water. The sediment also provides a steady source of extra nutrients which are readily used up in the initial days of incubation. An inused up in the initial days of incubation. An increase in incubation temperature enhanced caprolactam biotransformation. Maximum degradation of caprolactam should be expected in warm, nutrient rich waters where microbial growth and metabolic activity can be maximized and caprolactam concentration is not toxic, thus enabling the microbial population to utilize the chemical as a carbon and/or nitrogen source. Primary degradation appears to be more easily mediated by microorganisms than mineralization, suggesting the buildup of potentially aromatically-intact metabolites of caprolactam. (Baker-IVI) up in the initial days of incubation. An in

BIODEGRADABILITY TESTING OF POORLY WATER SOLUBLE COMPOUNDS.

Henkel K.G.a.A., Duesseldorf (Germany, F.R.). Dept. of Ecology. P. Gerike.

Chemosphere, Vol. 13, No. 1, p 169-190, 1984. 5 Tab, 23 Ref. Umweltbundesamt grant 10602010.

Descriptors: *Organic compounds, *Biodegradation, Industrial wastes, Solubility, Chemical reactions, Fate of pollutants.

The biodegradability testing of poorly water soluble compounds is methodologically much less developed than it is for soluble substances. A few prerequisites for the biodegradability evaluation of poorly water soluble compounds such as the selection of suitable biological and analytical parameters, dispersion techniques, introduction of the test compound into the culture medium, and the choice of suitable inoculum were elucidated. Furthermore, various published and established tests were scrutinized for their suitability for the purpose under discussion. It is suggested that a modified Blok method holds presently the most promise as a screening test for the biodegradability testing of poorly water soluble organic compounds. Also examined were the UK-MITI Test, the closed bottle test, the Sturm test, and the Muller-Tittizer test. (Baker-IVI) W85-01957

PREDICTION OF ECOTOXICOLOGICAL BE-HAVIOUR OF CHEMICALS: RELATIONSHIP BETWEEN N-OCTANOL-WATER PARTITION COEFFICIENT AND BIOACCUMULATION OF ORGANIC CHEMICALS BY ALGA CHLOREL-

LA, Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Okologische Chemie. H. Geyer, G. Politzki, and D. Freitag. Chemosphere, Vol. 13, No. 2, p 269-284, 1984. 4 Fig. 1

Descriptors: *Fate of pollutants, *Organic compounds, *Bioaccumulation, *Algae, Chemical properties, Lipophilicity, Lipids.

The bioaccumulation potential of the green alga Chlorella fusca for organic chemicals was deter-mined. Chemicals of different structures and physico-chemical properties were investigated to de-termine if there exists a relationship between the bioaccumulation factors of these compounds and their physicochemical properties. A quantitative relation was found between the lipophilicity (noctanol/water partition coefficient) of the chemicals and the bioaccumulation factor. (Baker-IVI)

CONTRIBUTION OF LEACHING OF DIAZINON, PARATHION, TETRACHORVINPHOS AND TRIAZOPHOS FROM GLASSHOUSE SOILS TO THEIR CONCENTRATIONS IN WATER COURSES, Institute for Pesticide Pagasola Wagnigation

Institute for Pesticide Research, Wageningin (Netherlands).
M. Leistra, L. G. M. Th. Tuinstra, A. M. M. van der Burg, and S. J. H. Crum.
Chemosphere, Vol. 13, No. 3, p 403-413, 1984. 1 Fig. 3 Tab, 25 Ref.

Descriptors: *Pesticides, *Leaching, *Water pollution sources, Diazinon, Parathion, Tetrachlorvin-phos, Triazophos, Organophosphates, Pesticide

Data on the adsorption and transformation rates of diazinon, parathion, tetrachlorvinphos and triazo-phos in soils were collected from a survey of the literature. As little information is available on their mobility, the adsorption of tetrachlorvinphos and triazophos on three soils was measured in a slurry experiment. Properties of diazinon were introduced into a computer model simulating glass-house soil systems in a simplified way. The leaching of diazinon from the root zone was calculated to be zero. The properties of the other three organ-ophosphates indicate that in similar computations

Group 5B—Sources Of Pollution

leaching from the root zone would have been even lower. Samples from tile drains and water courses in areas with many glasshouses were analyzed by gas-liquid chromatography. The concentration of the four organophosphate insecticides in almost all the samples of water from the tile drains was below the detectable limit. However, in samples from the water courses, pesticide residues were found regularly, sometimes at fairly high concentrations. Thus contamination of water courses would seem to be produced not by leaching of pesticides through the soil but by other pathways. (Baker-IVI) (Baker-IVI)

DISTRIBUTION OF NITRATES IN THE POTA-BLE WATERS OF SRI LANKA, Sri Lanka Univ., Peradeniya. Dept. of Geology. C. B. Dissanayake, S. V. R. Weerasooriya, and A.

Aqua, No. 1, p 43-50, 1984. 8 Fig. 2 Tab, 20 Ref.

Descriptors: *Nitrates, *Sri Lanka, *Potable water, Water analysis, Monitoring Water pollution sources, Fertilizers, Public health, Wastewater pol-

An island wide survey of the nitrate levels in the potable waters of Sri Lanka has been carried out. In general the nitrate levels in the drinking water supplies are below the danger limits specified by the World Health Organization. However, there appears to be an increasing tendency for nitrates to accumulate in the groundwater in regions of high population density. The wet zone of Sri Lanka has higher nitrate levels possibly due to the shallow water table into which nitrates percolate easily from the surface. In the dry zone of Sri Lanka. from the surface. In the dry zone of Sri Lanka, even though the use of agricultural fertilizer is higher, due to the deeper water table observed nitrate levels are low. Infant mortality rates though not caused solely by the high nitrate levels, are also highest in the highlands of the wet zone. The also highest in the highlands of the wet zone. The Juffna peninsula represents a very special case and this region contains the highest nitrate levels ob-served in Sri Lanka. The large usage of nitrogen-eous fertilizer such as urea, discharge of human excreta into the shallow water table and the pres-ence of highly fractured limestones as an aquifer are the chief reasons for the observed abundance. In other parts of Sri Lanka, densely populated areas contain higher nitrate contents and the island-wide distribution is influenced by climatic factors and fertilizer use as well. (Baker-IVI) W85-02015

PESTICIDES IN GROUNDWATER BENEATH THE CENTRAL SAND PLAIN OF WISCONSIN, Univ.-Madison.

Center.
J. M. Harkin, F. A. Jones, F. Fathulla, E. K.
Dzantor, and E. J. O'Neil.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-212372.
Price codes: A04 in paper copy, A01 in microfiche.
Technical Report No. WIS WRC 84-01, 1984. 46, 9, 9 Fig. 5 Tab, 24 Ref. Project No. OWRT A-094-WIS(1), Contract/Grant No. 14-34-0001-2153.

Descriptors: *Agricultural chemicals, Groundwater, Groundwater movement, *Groundwater pollution, *Pesticides, Soil properties, *Wisconsin, Central Sand Plain, Path of pollutants, Water pollution

Groundwater samples were collected periodically from monitoring wells and multilevel samplers in-stalled in nine 160-acre fields in the Central Sand stalled in nine 160-acre fields in the Central Sand Plain of Wisconsin. Potatoes were grown under irrigation in sandy soils over high water tables in each of these fields. All samples were tested for content of residues of aldicarb, a water-soluble systemic insecticide incorporated into soil once a systemic insecticate incorporated into soil once a year either with potatoes at planting soil once as lb/A or at shoot emergence at a rate of 2 lb/A. Regardless of application rate, timing or frequency (single or repeated applications in consecutive or alternate years) residues were found at some but not all locations tested within every field. Zones of contamination occurred only close to the water. contamination occurred only close to the water table and principally at locations where the soil

and groundwater pH and alkalinity were low. As contaminated water sank with time to lower depths in the aquifer (10 to 12 feet below the water table), the concentrations of aldicarb residues fell dramatically or disappeared altogether, apparently as a result of alkali-catalyzed hydrolysis and bacterial seated like attacking the property and the same physical disables attacking the property was a second property and the same physical seated parts of the same as a result of alkali-catalyzed hydrolysis and bacterial metabolism superimposed upon physical diution and dispersion. Samples of groundwater and aquifer sediments collected aseptically contained surprisingly high numbers of a large diversity of facultative anaerobic bacteria. These organisms can totally degrade aldicarb sulfone, and the major metabolites of aldicarb which occur in groundwater, at a rate which suggests a half-life of about 1.3 years for aldicarb residues in Wisconsin groundwater.

POTENTIAL EFFECTS OF SURFACE COAL MINING ON THE HYDROLOGY OF THE CORRAL CREEK AREA, HANGING WOMAN CREEK COAL FIELD, SOUTHEASTERN MON-

Geological Survey, Helena, MT. Water Resources

N. E. McClymonds

N. E. MCLIYMONDS. Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4260, 1984. 53 p, 9 Fig, 7 Tab, 22 Ref.

Descriptors: Hydrology, *Coal mines, Reclamation, *Montana, *Powder River Basin, Corral Creek, Hanging Woman Creek.

The Corral Creek area of the Hanging Woman Creek coal field, 9 miles east of the Decker coal mines near the Tongue River, contains large reserves of Federal coal that have been identified for serves of Federal coal that have been identified for potential lesse sale. A hydrologic study was conducted in the area to describe existing hydrologic systems and to study assess potential impacts of surface coal mining on local water resources. Hydrogeologic data collected indicate that aquifers are coal and sandstone beds within the Tongue River Member of the Fort Union Formation (Paleocene age) and sand and gravel in valley alluvimum (Pleistocene and Holocene age). Surface-water resources are limited to a few spring-fed stock ponds in the higher parts of the area and the intermittent flow of Corral Creek near the mouth. Most of the stock ponds in the area become dry by midsummer. Mining of the Anderson coal bed would remove three stock wells and would lower the potentiometric surface within the coal and would remove three stock wells and would lower the potentiometric surface within the coal and sandstone aquifers. The alluvial aquifer beneath Corral Creek and South Fork would be removed. Although mining would alter the existing hydro-logic systems and remove several shallow wells, alternative ground-water supplies are available that could be developed to replace those lost by mining. (USGS) W85-02040

HYDROLOGY OF AN ABANDONED COAL-MINING AREA NEAR MCCURTAIN, HAS-KELL COUNTY, OKLAHOMA,

Geological Survey, Oklahoma City, OK. Water Resources Div.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4202, 1983. 117 p, 12 Fig. 25 Tab. 43 Ref.

Descriptors: *Strip mines, Strip mine wastes, Mine drainage, Coal mines, Water quality, Land reclamation, *Oklahoma, Mule Creek, Hartshorne, McCurtain, Haskell County.

Bedrock in the area is shale, siltstone, sandstone, and coals of the McAlester and Hartshone Formations of Pennsylvanian age. The main avenues of water entry and movement are the exposed bedding plane openings, partings between laminae of shale, fractures and joints, and openings caused by surface mining. Water table conditions exist in bedrock and spoil in the area. Mine pond water is in direct hydraulic connection with water in the spoil piles and the underlying Hartshone Forma-tion. For both surface water and ground water, in the McCurtain area, Sulfate is the best indicator of coal mine drainage. Median sulfate concentrations for four sites on Mule Creek range from 26 to 260 milligrams per liter. Median sulfate concentrations increase with increased drainage from unreclaimed (abandoned) mined areas. Reclamation likely would result in decreased concentrations of dissolved solids, calcium, magnesium, sodium, sulfate, and alkalinity for Mule Creek in the vicinity of the reclaimed area. Water in the mine roads is quite. and analysis of Muter Clear in the winning of the similar to the shallow ground water. Water from ponds and ground water are unlikely in the long run to be changed by reclamation in the area. W85-02041

CALIBRATION AND VERIFICATION OF A RAINFALL-RUNOFF MODEL AND A RUNOFF-QUALITY MODEL FOR SEVERAL URBAN BASINS IN THE DENVER METRO-POLITAN AREA, COLORADO,

Geological Survey, Lakewood, CO. Water Resources Div. For primary bibliographic entry see Field 2A. W85-02044

SEDIMENTATION IN FLUVIAL AND LACUS-TRINE ENVIRONMENTS, Ottawa Univ. (Ontario). Dept. of Geology. For primary bibliographic entry see Field 2J. W85-02057

GEOCHEMISTRY OF THE RHINE AND THE RHONE AND HUMAN IMPACT (LA GEOCHI-MIE DU RHIN ET DU RHONE ET L'IMPACT

Centre d'Ecologie de Camargue (France). For primary bibliographic entry see Field 2H. W85-02059

WHOLE-LAKE LEAD BURDENS IN SEDI-MENTS OF LAKES IN SOUTHERN ONTARIO,

MENIS OF LAKES IN SOUTHERN ONTARIO, CANADA, Ontario Ministry of the Environment, Rexdale. P. J. Dillion, and R. D. Evans. Hydrobiologia, Vol. 91, p 121-130, July, 1982. 4 Fig. 3 Tab, 18 Ref.

Descriptors: *Lead, *Ontario, *Lake sediments, Path of pollutants, Lakes, Sediments, Heavy metals, Atmospheric deposition, Deposition, Water

The anthropogenic stable lead content of the sediments of eight softwater Precambrian lakes in southern Ontario was measured at 34-92 sites per lake. Whole-lake anthropogenic lead burdens varied between only 610 and 770 mg/sq m. There was no relationship between lead burden and either water replenishment time of the lake (Tw) or the ratio of watershed area to lake area (A sub-lake area (A). or the ratio of watershed area to lake area (A sub d/A sub 0), which varied by factors of 4 and 12 respectively. These results can be explained if; a) the lead deposition in this region is uniform, and b) the only significant input of lead to the lakes is deposition from the atmosphere directly on the lakes' surfaces. Therefore spatial differences in antropogenic lead within a lake represent the redistribution of focusing pattern of the sediments. (Author's abstract) thor's abstract) W85-02062

HISTORICAL CHANGES IN ANTHROPOGEN-IC LEAD FALLOUT IN SOUTHERN ONTAR-IO, CANADA, Trent Univ., Peterborough (Ontario). R. D. Evans, and P. J. Dillion.

Hydrobiologia, Vol. 91, p 131-137, July, 1982. 5 Fig, 19 Ref.

Descriptors: *Ontario, *Lead, *Found Lake, *Red Chalk Lake, *Bob Lake, Lake sediments, Water pollution sources, Path of pollutants, Sediments, Meromictic lakes, Dimictic lakes.

By combining the relative change in lead fallout through time, as observed in a meromictic lake,

Sources Of Pollution—Group 5B

with the total atmospheric deposition of lead, a historical record of lead deposition for remote areas can be developed. Sediment cores were collected in 1978 from meromictic Found Lake and from dimictic Red Chalk and Bob Lakes, in the Muskoka-Haliburton area of Ontario. For each of these sediment cores, a historical record of lead deposition at the sampling station was calculated. Lead deposition rose late in the nineteenth century and reached a maximum in the most recent sediments. Total lead deposition was assumed to be the average of that measured for eight other lakes in the study area; approximately 680 mg of anthropogenic lead per sq m have been deposited there. The validity of this historical record was tested on sediment cores from the two nearby dimictic lakes. A simplistic mixing model was used to predict lead profiles in the dimictic lakes. Predicted lead concentration profile closely resembled observed profiles. The historical record suggests that the primary source of anthropogenic lead in Haliburton is from non-local sources. (Collier-IVI)

ZINC IN WATER AND SEDIMENTS OF TWO FINNISH LAKES,

Tampere Univ. of Technology (Finland). L. Koivo, and R. Oravainen. Hydrobiologia, Vol. 91, p 155-160, July, 1982. 1 Fig. 5 Tab, 14 Ref.

Descriptors: *Lake Vanajavesi, *Lake Mallasvesi, *Finland, *Zinc, *Path of pollutants, Water pollution effects, Lake sediments, Industrial wastewater, Textile industry, Industrial plants, Water pollution sources, Heavy metals, Metals.

The occurence, distribution, and sedimentation of zinc was studied in water and sediment samples from Lake Vanajavesi and Lake Mallasvesi, in the from Lake Vanajavesi and Lake Mallasvesi, in the Kokemaenjoki watercourse, South Finland. Lake Vanajavesi is one of the most polluted of large inland lakes in Finland. The zinc load comes mainly from industrial sources. Lake Mallasvesi, situated near Vanajavesi, is in an almost natural condition. The zinc concentrations in water (micrograms/L) vary between < 10 and 4,000 in Vanajavesi and < 10 in Mallasvesi. Sediment concentrations of zinc (g/kg DW) ranged from 0.2 to 13.2 in Vanajavesi and from 0.2 to 0.5 in Mallasvesi. A close correlation between sedimentation of zinc and waste discharge from a textile factory was vesi. A close correlation between sedimentation of zinc and waste discharge from a textile factory was found. During several winters, zinc has spread with waste water to different parts of Vanajavesi against the main course of flow. The flow is due to the movement of contaminated bottom water along a series of depressions in the lake bed. The entrainment is probably caused by great differences in density. The maximum zinc concentrations observed in Lake Vanajavesi are high enough to cause both acute and sublethal effects on lacustrine organisms. (Collier-IVI)

MODEL FOR INSTREAM REGULATION OF RADIOISOTOPES AND HEAVY METALS IN RIVERINE WATERS SUBJECTED TO A URA-NIUM MILL DISCHARGE, Beak Consultants Ltd., Mississauga (Ontario).

M. Holloran.

Hydrobiologia, Vol. 91, p 175-188, July, 1982. 9 Fig. 4 Tab, 10 Ref.

Descriptors: *Saskatchewan, *Uranium mills, *Industrial wastewater, *Radioisotopes, *Radioactive wastes, Heavy metals, Thorium, Mathematical models, Nickel, Lead, Radium, Interstital water, Fluvial sediments, Path of pollutants, Mine wastes.

In the Athabaska sandstone region of northern Saskatchewan, mining and milling of uranium-bearing ore is subjecting, and will continue to subject, surface waters to inputs of soluble heavy metal and uranium and thorium decay series radioisotopes. A mathematical simulation model was desotopes. A mathematical simulation model was de-veloped to assess the role of riverine sediments in regulating soluble concentrations of heavy metals and radioisotopes released to the environment through treated mining and milling process ef-fluents. Specific elements studied included As, Ni, Pb, U, and Ra-226. The model considered that

diffusion into sediment porewater and adsorption by sediment particulates from sediment porewater were the two dominant mechanisms regulating sediment loading. Experiments indicated that the equilibrium adsorption behavior of the heavy metals and radioisotopes studied could be adequately explained using a linear adsorption isotherm, over the range of concentrations expected in the environment. Experimentally determined linear isotherm slopes ranged from 200 ml/g to 21,000 ml/g. Diffusion into the effective depth of the sediments (20 cm) was modelled using a quadratic (second order) driving force and a corresponding mass transfer coefficient. The model coefficients were calibrated using field and laboratory data. Results of the modelling suggested that the sediments have a small effect on instream concentrations during the active phases of mining and milling. The sediments were predicted to accumulate sufficient adsorbed mass, during the operational phase of mining and milling, to act as a distributed instream source after completion of milling activities. The significance of this post-operational source was a function of the initial effluent loading, elapsed time and site specific river characteristics. (Author's abstract) elapsed time and site specific river characteristics.
(Author's abstract)
W85-02068

EXPERIMENTAL MEASUREMENT OF SEDI-MENT NITRIFICATION AND DENITRIFICA-TION IN HAMILTON HARBOUR, CANADA, McMaster Univ., Hamilton (Ontario). For primary bibliographic entry see Field 2H. W85-02070

PARTITIONING OF PHOSPHORUS BETWEEN PARTICLES AND WATER IN A RIVER OUTFLOW, New York State Coll. of Agriculture and Life Sciences, Ithaca. Ecology and Systematics Section. For primary bibliographic entry see Field 2H. W85-02075

ACCUMULATIVE PHASES FOR HEAVY METALS IN LIMNIC SEDIMENTS, Technische Univ., Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.

U. Forstner. Hydrobiologia, Vol. 91, p 269-284, July, 1982. 5 Fig, 5 Tab, 87 Ref.

Descriptors: *Heavy metals, *Lake sediments, *Clays, Acid rain, Zinc, Cobalt, Nickel, Lead, Copper, Cadmium, Iron oxides, Magnesium oxides, Carbonates, Sulfides, Fate of pollutants, Lakes.

Carbonates, Sulfides, Fate of pollutants, Lakes. Data from mechanical concentrates of recent sediments indicate that clay minerals, clay-rich aggregates and heavy minerals are the major carriers of heavy metals in detrital sediment fractions. Hydrous Fe/Mn oxides and carbonates and sulfides, in their specific environments, are the predominant accumulative phases for heavy metals in autochthonous fractions. Sequential chemical extraction techniques permit the estimation of characteristic heavy metal bonding forms: exchangeable metal cations, easily reducible, moderately reducible, organic and residual metal fractions, whereby both diagenetic processes and the potential availability of toxic compounds can be studied. The data from lakes affected by acid precipitation indicate that zinc, cobalt and nickel are mainly released from the easily reducible sediment fractions and cadmium from organic phases. In contrast at pH 4.4, neither lead nor copper seem to be remobilized to any significant extent. Immobilization by carbonate precipitation seems to provide an effective mechanism for the reduction of dissolved inputs of metals such as zinc and cadmium in pH-buffered, hard water systems. (Author's abstract)

HYDROCARBON ACCUMULATION IN FRESHWATER SEDIMENTS OF AN URBAN

Middlesex Polytechnic, London (England). Urban Stormwater Pollution Research Group. A. Gavens, D. M. Revitt, and J. B. Ellis. Hydrobiologia, Vol. 91, p 285-292, July, 1982. 6 Fig, 2 Tab, 16 Ref.

Descriptors: *London, *England, *Hydrocarbons, *Sediments, Aliphatic hydrocarbons, Phytane, Pristane, Urban watersheds, Path of pollutants.

The top and bottom of two sediment cores collected from an urban receiving basin in NW London, and stormwater samples from the attendant catchment, have been analyzed for their hydrocarbon content. In surface sediments, basal sediments and stormwater, total aliphatic hydrocarbon levels are 445-690 micro g/g gry wt., 43-224 micro g/g and 0.36-1.10 mg/L, respectively; and total levels of polyaromatic hydrocarbons (PAHs) are 780-1,100 micro g/g 310-640 micro g/g and 5.83-18.21 mg/L, respectively. Biodegradation of aliphatics is assessed by phytanear-C18 and pristanear-C17 ratios. Hydrocarbon sources are determined from phytane-pristane ratios, oddeven carbon chain length ratios, the presence of an unresolved complex mixture, and by comparison of the amount of methyl-substituted PAHs with that of the parent compounds. Comparison of total levels between metnyl-substituted PAHs with that of the parent compounds. Comparison of total levels between surface and basal sediments shows a 1 to 3 fold increase in total PAHs and a 3 to 10 fold increase in aliphatic hydrocarbons over a 120 year period. (Author's abstract) W85-02078

DYNAMICS AND MECHANISMS OF ARSEN-ITE OXIDATION BY FRESHWATER LAKE SEDIMENTS,

Saskatchewan Univ., Saskatoon. Dept. of Soil Sci-

P. M. Huang, D. W. Oscarson, W. K. Liaw, and U.

P. M. Huang, D. H. C. T. Hammer.
Hydrobiologia, Vol. 91, p 315-322, July, 1982. 2
Fig. 5 Tab, 30 Ref. Natural Sciences and Engineering Research Council of Canada grants A3248, G0042, and G0515.

Descriptors: *Arsenic, *Lake sediments, *Oxida-tion, Adsorption, Arsenite, Lakes, Arsenate, Mag-nesium, Carbonates, Silicates, Saskatchewan, Sedi-ments, Fate of pollutants.

There has been increasing concern over As in freshwater environments from sources such as arsenical pesticides, amelters, coal-fired power plants, and erosion caused by intensive land use. Arsenic in the reduced state, As (III) (arsenite) is much more toxic, more soluble and mobile, than when in the oxidized state, As (V) (arsenate). This paper summarizes the dynamics and mechanisms involved in the oxidation of As (III) to As (V) by freshwater lake sediments. Sediments from selected freshwater lakes in southern Saskatchewan oxidize resinwater take seatments. Seatments from selected freshwater lakes in southern Saskatchewan oxidize As (III) to As (V) predominantly through an abiotic process. Solution analysis of As (III) and As (V) by colorimetry, and examination of the oxidation state of surface-sorbed As species by X-ray photoelectron spectroscopy, indicate that Mn present in the sediment is the primary electron acceptor in the sediment is the primary electron acceptor in the oxidation of As (III). The transformation of As (III) to As (V) by carbonate and silicate minerals, common in sediments, is not evident. The heat of activation, delta H sub a, for the depletion (oxidation plus sorption) of As (III) by the sediments, varies from 3.3 to 8.5 kcal/mole, indicating that the process is predominantly diffusion-controlled. The Mn present in a series of particle size fractions (<2 ->20 um) of the sediments may potentially detoxify As (III) in aquatic systems, by converting it to As (V). (Author's abstract) W85-02080

DISTRIBUTION AND CONCENTRATIONS OF NATURALLY-OCCURRING RADIONUCLIDES IN SEDIMENTS IN A URANIUM MINING AREA OF NORTHERN SASKATCHEWAN, CANADA,

Monenco Consultants Ltd., Calgary (Alberta). P. A. Neame, J. R. Dean, and B. G. Zytaruk. Hydrobiologia, Vol. 91, p 355-361, July, 1982. 3 Fig. 4 Tab, 18 Tab.

Descriptors: *Saskatchewan, *Radionuclides, *Sediments, *Uranium mining, Thorium, Radium Polonium, Lead, Adsorption, Industrial wastes, Mine wastes, Path of pollutants. *Radionuclides,

Group 5B-Sources Of Pollution

Uranium mining and milling operations can contribute to environmental degradation through the increased release of naturally-occurring radionuclides. However, studies of the interactions of these radionuclides with freshwater sediments have been limited. The present study examined the vertical distribution of uranium, thorium, radium-226, polonium-210 and lead-210 in undisturbed sediment cores collected in the vicinity of mining, milling and exploration activities. Uranium levels in surface sediments ranged from 1.9 to 5650 micro g/g, Ra-226 from < 0.1 to 480 pCi/g and Pb-210 from 0.8 to 931 pCi/g in the samples reported here, with the highest values occurring downstream of wasterock disposal areas. Concentrations usually decreased with depth, and there was little evidence of any strong effect of bioturbation on radionuclide profiles at the scale examined here. Mathematical models of uranium and radium-226 adsorption on and movement into the sediment were constructed, based on expected adsorption coefficients and estimated loading. The model predictions of radionuclide distribution with depth were qualitatively similar to those actually measured, but the predicted concentrations were generally lower than those observed, both in unaffected areas and in areas adjacent to uranium extraction activities. (Author's abstract) stract)

INFLUENCE OF WITHIN-STREAM DISTURB-ANCE ON DISSOLVED NUTRIENT LEVELS DURING SPATES,

Freshwater Biological Association, Wareham (England). River Lab. For primary bibliographic entry see Field 2E. W85-02089

DISSOLVED AND SUSPENDED MERCURY SPECIES IN THE WABIGOON RIVER (ON-TARIO, CANADA): SEASONAL AND REGION-

TARIO, CANADAF. SEASONAL AND REGION-AL VARIATIONS,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
T. A. Jackson, J. W. Parks, P. D. Jones, R. N. Woychuk, and J. A. Sutton. Hydrobiologia, Vol. 92, p 473-487, July, 1982. 13 Fig. 2 Tab, 29 Ref.

Descriptors: *Speciation, *Mercury, *Fate of pol-lutants, *Wabigoon River, *Ontario, Seasonal vari-ation, Regional variation, Heavy metals, Organic compounds, Particulates, Sediment erosion.

Seasonal and regional variations in the speciation, sediment-water partitioning, and dynamics of mercury were studied at selected sites along the Hgpolluted Wabigoon River, and at unpolluted headwater and tributary sites, during April-September, 1979. CH3Hg(+) and inorganic Hg in Wabigoon River Water are predominantly particulate during the spring flood. In summer, particulate forms decline sharply while dissolved forms increase. In spring, transfer of Hg species from bottom sediments to water is due chiefly to physical erosion and resuspension of sediments by current action. Particulate Hg species are not readily solubilized, and are probably not readily available to organisms. Thus, the particulate Hg species mobilized in the spring are probably less bioavailable than the dissolved forms mobilized in the summer. Hg bound to wood-chip deposits blanketing the riverbed near the source of pollution appears to be less readily desorbed and methylated, and therefore less bioavailable than Hg bound to the silt clay mud. In the mid-summer, the dissolved Ch3Hg(+) level was a function of total dissolved Hg concentration. Hg species in particulates are associated with sulfide, iron and manganese oxides, organic and selenium. Any program for pollution control short of total removal of Hg from bottom sediments, would have to include immobilization, removal, or detoxification of the dissolved as well as the suspended forms of Ch3Hg(+) and inorganic Hg in the Wabigoon River water upstream from the lakes through which the contaminated water flows. (Baker-IVI) Seasonal and regional variations in the speciation,

MECHANISMS FOR RELEASE OF SEDI-MENT-BOUND PHOSPHATE TO WATER AND

THE EFFECTS OF AGRICULTURAL LAND MANAGEMENT ON FLUVIAL TRANSPORT OF PARTICULATE AND DISSOLVED PHOS-

PHATE, Ohio State Univ., Columbus. Dept. of Agronomy. T. J. Logan. Hydrobiologia, Vol. 92, p 519-530, July, 1982. 6

Descriptors: *Phosphates, *Lake sediments, *Particulates, Dissolved solids, Fate of pollutants, Water pollution sources, Water pollution control, Adsorption, Desorption.

Adsorption, Desorption.

The bulk of the phosphate load to lakes is from land drainage, and includes varying proportions of sediment-bound P and dissolved P. P sources which may enter a lake through land drainage include native soil phosphate, fertilizer P, and live-stock and municipal wastes. Sediment-bound phosphate includes organic and inorganic forms, but the inorganic fraction contains most of the P that can be released into water. The non-apatite inorganic P (NAIP) fraction of sediment-bound phosphate varies considerably with geochemistry and anthropogenic additions. A small fraction of the NAIP is sufficiently labile to desorb into water, and this release can be described by dissolution or adsorption/desorption mechanisms. Agricultural practices, such as phosphate fertility management and conservation tillage, which affect the levels of phosphate and sediment leaving the land, will determine the partition of sediment-bound P and dissolved P in water draining into lakes. The response of algae to dissolved P must be different than to particulate P sources, which may settle out of the photic zone before thay can be completely utilized. Phosphorus control strategies for deep lakes, with little sediment resuspension or lake overturn, must emphasize dissolved P sources more than for shallower lakes, where sediments are continuously resuspended and lake overturn can bring P released from bottom sediments to the surface. (Moore-IVI)

SUMMER PEAK OF NUTRIENT CONCENTRATIONS IN LAKE WATER.

Japan Bottom Sediment Managem Tokyo. T. Yoshida.

Hydrobiologia, Vol. 92, p 571-578, July, 1982. 15 Fig, 2 Tab, 1 Ref.

Descriptors: *Nutrients, *Lake sediments, *Lake Suwa, *Lake Koyamaike, *Japan, Seasonal varia-tion, Water pollution sources, Water pollution con-trol, Mathematical studies, Simulation, Lakes.

Lake water nutrient concentrations are strongly influenced by both inflowing nutrients and nutrients released from lake sediments. The problem of how the summer peak may be generated is considered, using actual data from two lakes in Japan. Lake Suwa is situated in the mountain district near the Nippon Alps. Three cities are located around it, and the district has a number of manufacturing industries and a large tourist industry. Lake Koyamaike is situated in the western district facing the Nippon Sea, which has the lowest population density in Japan. Although no factories and no big cities are located around it, the lake is polluted. A mathematical simulation indicates that the summer peak may be generated largely from nutrient material released from sediment. Using this approach, release rates have been calculated for the two lakes. Sediment removal seems to be an effective lakes. Sediment removal seems to be an effective and immediate way to release the summer peak. (Moore-IVI) W85-02098

URBAN RUNOFF AS A SOURCE OF POLYCY-CLIC AROMATIC HYDROCARBONS TO COASTAL WATERS, E. J. Hoffman, G. L. Mills, J. S. Latimer, and J. G.

Quinn. Environmental Science and Technology, Vol. 18, No. 8, p 580-587, August, 1984. 2 Fig, 6 Tab, 31 Ref. NOAA grant NA80RAD00047.

Descriptors: *Urban runoff, *Polycyclic aromatic hydrocarbons, *Water pollution s

gansett Bay, Coastal waters, Land use, Aromatic compounds, Hydrocarbons, Particulates, Rainfall, Storm runoff, Highways, Industrial areas, Residen-

Urban runoff samples collected from four storm drains, each serving a different land use, were analyzed for selected polycyclic aromatic hydrocarbons (PAHs) by gas chromatography. The PAH concentrations varied widely during the history of each storm and appeared to be most concentrated in first or second flushes. Higher molecular weight PAHs were mostly found associated lar weight PAHs were mostly found associated with the particulates and were enriched on two different particle sizes, a small particle fraction and a larger particle fraction, perhaps from different sources. The annual input of PAHs to the upper Narragansett Bay watershed was calculated by using storm loads with local rainfall and land use data. The loads of PAHs (mass/(drainage area)/ year) in urban runoff were higher at the highway and industrial land uses in comparison to the commercial and residential areas. Urban runoff PAHs are similar in composition to that found in atmosare similar in composition to that found in atmospheric fallout but unlike the PAHs in municipal effluents. Comparison of urban runoff PAH inputs to other sources entering Narragansett Bay showed that urban runoff accounted for 71% of the total inputs for higher molecular weight PAHs and 36% of the total PAHs. (Author's abstract) W85-02108

SOLUBILITY OF ORGANIC MIXTURES IN

Syracuse Research Corp., NY. Life and Environntal Sciences Div.

Environmental Science and Technology, Vol. 18, No. 8, August, 1984. 9 Tab, 22 Ref. EPA grant R808613.

Descriptors: *Organic compounds, *Solubility, *Toxicity, Chlorobenzenes, Phase, Hydrophilicity, UNIFAC equation, Mixtures.

Environmental contaminants are frequently en-countered as mixtures, and the behavior of a compound in a mixture may not correspond to that predicted from pure component data. The solubilities of several chlorobenzenes and other mixtures in water were determined. The results varied with in water were determined. The results varied with the phase of the solute mixture and the hydrophilicity of the components and were interpreted through activity coefficients calculated by the UNIFAC equation. Mixtures of structurally related hydrophobic liquids were near ideal in the organic phase; in the aqueous phase the activity coefficient of a component was unaffected by the presence of cosolutes. Increasing hydrophilicity of the solutes led to deviations from ideality in the organic phase, but these could be largely accounted for by the UNIFAC equation. For mixtures of solids which did not interact, the components tended to behave independently of one another, and their solubilities were approximately additive. The behavior of mixtures of liquids and solids was intermediate between that of liquid mixtures and that of mixtures of solids. These conclusions are of particular relevance to toxicity studies in that they particular relevance to toxicity studies in that they can be used to estimate limiting toxicities of mixtures. In the absence of biological interaction, the toxicity of a saturated solution derived from a toxicity of a saturated solution derived from a mixture of liquids will be less than that of a corre-sponding saturated solution obtained from its most toxic component. The opposite argument applies for solids since their solubilities are roughly addi-tive. (Moore-IVI) W85-02109

CHARACTERISTICS OF LEACHATES FROM HAZARDOUS WASTE LANDFILLS, Multidisciplinary Energy and Environmental Systems and Applications, San Pedro, CA. M. Ghassemi, S. Quinlivan, and J. Bachmaier. Journal of Environmental Science and Health, Vol. Alp, No. 5, p 579-620, 1984. 12 Tab, 9 Ref. EPA contract 68-02-3174.

Descriptors: *Leachates, *Landfills, *Hazardous materials, Data base, Organic compounds, Inor-

Sources Of Poliution—Group 5B

ganic compounds, Land disposal, Liners, Water pollution sources.

pollution sources.

A hazardous waste landfill leachate data base covering some thirty leachates from eleven disposal sites has been developed. The sites cover a range of sizes, liner designs, waste types and leachate collection systems and the leachate data cover a range of organic and inorganic constituents. For the cases included, the inorganic constituents appearing in highest concentrations in the leachate are iron, calcium, magnesium, cadmium, and arsenic, and the organic constituents appearing in highest concentrations are acetic acid, methylene chloride, butyric acid, 1,1-dichloroethane, and trichlorofluoromethane. The constituent concentrations in the leachate from hazardous waste landfills fall within the reported ranges for municipal landfill leachate. Based on preliminary data, only gross correlations could be made between leachate quality and waste input. (Author's abstract)

MICROBIAL DEGRADATION OF 2,4,6-TRICH-LOROANILINE IN AQUATIC SAMPLES AND LABORATORY ENRICHMENT CULTURES, Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
W. R. Mitchell, S. H. Hoke, and A. B.

Journal of Environmental Science and Health, Vol. A19, No. 6, p 679-696, 1984. 2 Fig, 2 Tab, 28

Descriptors: *Trichloroaniline, *Microbial degradation, *Canal Creek, *Maryland, Fate of pollutants, Anilines, Stream sediments, Microorganisms,

Canal Creek is a smail stream at the Aberdeen Proving ground, MD, the sediments of which were believed to be contaminated with 2,4,6-trichloroaniline (2,4,6-TCA). Water samples containing bottom sediments were collected from Canal Creek near the mouth of its outflow to the Gunpowder River, and from four other sites near Frederick, MD, for purposes of comparison. Microorganisms present in water samples obtained from Canal Creek degraded 2,4,6-TCA following a prolonged acclimation period. Creek water sediments, but not the co-substrate aniline, reduced the lag time prior to degradation. The microorganisms in the samples could be enriched to grow on 2,4,6-TCA as indicated by increases in carbon dioxide, the samples could be enriched to grow on 2,4,6-TCA as indicated by increases in carbon dioxide, chloride, and adenosine triphosphate and by slight biomass increases accompanying the degradation of the compound. Uptake of 2,4,6-TCA by the enrichment population was as rapid as that of the original sample population but was without an apparent lag. Similar enrichment cultures could not be developed from five other sites. The lengthy acclimation period prior to 2,4,6-TCA degradation in the original creek water samples could indicate that the microorganisms present had not been exposed to the compound in sufficient quantity to bring about their adaption and enrichment as a natural population. (Moore-IVI) W85-02120 W85-02120

SOME OBSERVATIONS ON THE CHEMICAL COMPOSITION OF PRECIPITATION IN AN INDUSTRIAL AREA AND IT'S USE IN AIR

UNJUSTRIAL AREA AND 11'S USE IN AIR QUALITY ASSESSMENT,
Bhabha Atomic Research Centre, Bombay (India).
Air Monitoring Section.
T. N. Mahadevan, V. Meenakshy, and A. P. Sathe.
Mausam, Vol. 35, No. 1, p 87-90, 1984. 4 Fig, 1

Descriptors: *Precipitation scavenging, *Pollutant identification, *Air pollution, *Chemical composition, *India, *Chemistry of precipitation, *Failout, *Acid rain, Monitoring, Sulfur compounds, Stochastic Process, Sampling network.

Precipitation samples collected from seven sites situated in a major industrial region in Bombay during the 1980 monsoon period were analyzed for pH, S04, Cl, NO3, NH4, and F ion concentrations. Barring one site which showed predominately acid rains, samples from other sites were found to be

alkaline in nature. Data obtained suggest a pre-dominant SO4 excess at two of the sites where the prime source is SO2. Higher levels of fluoride and nitrate were found at four of the sites indicating a local source. SO4 and NH4 excesses are estimated with reference to their stoichiometric ratios. Fluo-ride deposition due to precipitation washout around the fertilizer industry is assessed and the overall results of the study discussed. (Author's abstract) abstract) W85-02129

EFFECT OF SUBSTRATE CONCENTRATION AND ORGANIC AND INORGANIC COMPOUNDS ON THE OCCURRENCE AND RATE OF MINERALIZATION AND COMETABOLISM, Cornell Univ., Ithaca, NY. Lab. of Soil Microbi-

ology. Y.-S. Wang, R. V. Subba-Rao, and M. Alexander. Applied and Environmental Microbiology, Vol. 27, No. 6, p 1195-1200, June, 1984. 3 Fig. 3 Tab, 22

Descriptors: *Mineralization, *Cometabolism, *Fate of pollutants, Metabolism, Organic com-pounds, Inorganic compounds, Natural waters, Carbamates, Chlorinated hydrocarbons.

Carbamates, Chlorinated hydrocarbons.

Isopropyl N-phenylcarbamate (IPC) at 400 pg and 1 micro g/ml was mineralized in samples of sewage, but only the lower concentration was mineralized in lake water samples in a 50-day period. IPC at 1 micro g/ml disappeared from lake water, but it was converted to organic products. Minerelization of IPC at 400 pg/ml in lake water was enhanced by additions of inorganic nutrients or a mixture of nonchlorinated water pollutants but not by yeast extract of mixtures containing aromatic compounds or excretions of primary producers. The mineralization of 200 pg of 2,4-dichlorophenoxyacetate per ml of lake water was not affected by additions of low levels of yeast extract or compounds excreted by primary producers but was enhanced by low concentrations of mixtures of water pollutants. It is suggested that some chemicals that are found to be converted only to organic products, presumably by cometabolism, in tests using the concentrations commonly employed in laboratory evaluations may be mineralized at the lower concentrations prevailing in natural waters. (Author's abstract)

EFFECTS OF URBANIZATION ON FREQUENCIES OF OVERFLOWS AND POLLUTANT LOADINGS FROM STORM SEWER OVERFLOWS: A DERIVED DISTRIBUTION AP-PROACH.

PRUACH, Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Civil Engineering.
G. V. Loganathan, and J. W. Delleur.
Water Resources Research, Vol. 20, No. 7, p. 857-865, July, 1984. 7 Fig. 4 Tab, 23 Ref. 1 Append.
OWRT project OWRT-A-057 IND.

Descriptors: *Urban runoff, *Storm wastewater, *Water pollution sources, Storm sewer overflows, Storm runoff, River flow, Analytical models, Dis-tribution, Urbanization, Biochemical oxygen

On the basis of exponential density functions for volume of runoff, interevent time, and duration of runoff event and beta density for the rescaled pollutant (biochemical oxygen demand) concentration, and gamma density for river flow volumes during a critical period, new distributions are derived for overflow volumes and for quality of pollutant in the river after mixing with the untreated overflows of the overtaxed system. This is accomplished by means of hydrological relationships between different variables. The current data on runoff volume, duration of runoff events, etc., are transformed to account for future urbanization activities. The newly formed variables are used in the derivation of probability distributions for overactivities. The lewly lottined variables are used in the derivation of probability distributions for over-flows and receiving body pollutant concentration after urbanization. The analytical model is com-pared with the simulation model 'STORM.' (AuFLUX-AVERAGED AND VOLUME-AVER-AGED CONCENTRATIONS IN CONTINUUM APPROACHES TO SOLUTE TRANSPORT, Virginia Polytechnic Inst. and State Univ., Blacks-For primary bibliographic entry see Field 2F. W85-02153

CONTAMINANT TRANSPORT IN FRACTURED POROUS MEDIA: ANALYTICAL SOLUTION FOR A TWO-MEMBER DECAY CHAIN IN A SINGLE FRACTURE,

Waterloo Univ. (Ontario). Dept. of Earth Sciences. Water Resources Research, Vol. 20, No. 7, p 1021-1029, July, 1984. 4 Fig. 14 Ref.

Descriptors: *Path of pollutants, *Geologic fractures, *Radioactive decay, *Porous media, *Chain decay, Advection, Diffusion, Adsorption, Radioisotopes, Radioactive half-life.

An analytical solution is presented for the problem of radionuclide chain decay during transport through a discrete fracture situated in a porous rock matrix. The solution takes into account advection along the fracture, molecular diffusion from the fracture to the porous matrix, adsorption on the fracture face, adsorption in the rock matrix, and radioactive decay. The solution for the daugh-ter product is in the form of a double integal which is evaluated by Gauss-Legendre quadrature. Re-sults show that the daughter product tends to advance ahead of the parent nuclide even when the half-life of the parent is larger. This is attributed to the effect of chain decay in the matrix, which tends to reduce the diffusive loss of the daughter along the fracture. The examples also demonstrate the the fracture. The examples also demonstrate the neglecting the parent nuclide and modeling its daughter as a single species can result in significant overestimation of arrival times at some point along the fracture. Although the analytical solution is restricted to a two-member chain for practical reasons, it represents a more realistic description of nuclide transport along a fracture than available single-species models. The solution may be of use for application to other contaminants undergoing different types of first-order transformation reactions. (Author's abstract)
W85-02170

EFFECT OF CLEAR-CUT SILVICULTURE ON DISSOLVED ION EXPORT AND WATER YIELD IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Re-

J. D. Hewlett, H. E. Post, and R. Doss Water Resources Research, Vol. 20, No. 7. p 1030-1038, July, 1984. 5 Fig. 5 Tab, 31 Ref.

Descriptors: *Clear-cutting, *Solute transport, *Water yield, *Piedmont, *Georgia, Water quality, Water pollution sources, Nitrogen, Phosphorus Potassium, Calcium, Magnesium, Sodium.

A paired watershed experiment on Putnam County, Georgia, was carried out from 1973 to 1980 to determine the effects of a typical southern clear-cut operation on water quality, timing, and yield. This report shows that increases in monthly exports of dissolved N, P, K, Ca, Mg, Na, TKN, and total electrolytes were short-lived and less than 0.5 kg/ha/month and may therefore be considered minor for practical purposes. Stream water than 0.5 kg/ha/month and may therefore be considered minor for practical purposes. Stream water concentrations were mostly diluted by clear-cutting, but a monthly water yield increase of 1 to 2 cm flushed an extra 0.15 kg/ha/month of nitrate-nitrogen from the basin during a 2-year period following harvest. Twenty surrounding forested basins (7 to 165 ha in area) were sampled monthly for 1 year, showing that the experimental pair was representative of the general levels of dissolved ions in forested Piedmont streams. Results suggest ions in forested Piedmont streams. Results suggest that clear-cut silviculture in this region will neither reduce soil fertility by flushing ions into streams nor eutrophy stream water. (Author's abstract)

Group 5C-Effects Of Pollution

5C. Effects Of Pollution

ORGANIC WASTEWATER EFFECTS ON INVERTEBRATES IN MANAWATU RIVER.

MANAWATU MIVER, Massey Univ., Palmerston North (New Zealand). Dept. of Biotechnology. D. M. Suckling. New Zealand Journal of Marine and Freshwater Research, Vol. 16, No. 3/4, p 263-270, 1982. 4 Fig.

Descriptors: *New Zealand, *Manawatu River, *Water pollution effects, *Benthos, *Invertebrates, Aquatic insects, Midges, Mayflies, Species diversi-ty, Species composition, Agricultural runoff, Or-

The effects of the 3 main wastewater discharges on the benthic fauna of the Manawata River (New Zealand) were studied between March 1979 and January 1980. At least 4 replicate Surber samples were taken from each of 6 sites, on 5 occasions during this period. Deleatidium sp. (Ephemeroptera), Hydora sp. (Coleoptera), and the Chironomidae were the most useful indicator organisms, according to a ranking system based on the occurrence of significant differences (Pc. 0.05) between populations at different sites. These taxa exhibited significant differences between sites in about 70% of all inter-site comparisons, using Mann-Whitney U-tests. The Coefficient of Similarity was successful at summarizing the comparisons between the The effects of the 3 main wastewater discharges on U-tests. The Coefficient of Similarity was successful at summarizing the comparisons between the clean-water and down-stream sites, ranging between 95% similarity to the clean-water site for a recovery site in winter, and less than 10% similarity to the clean water site for the lower reaches in summer. It is suggested that relative indices may be more appropriate than absolute indices for measuring water pollution. Water quality, indicated by species diversity, was generally good (allowing for the effects of agricultural runoff), although midsummer organic loading induced marked changes in benthic species composition, including the disappearance of Deleatidium sp, from several sites. (Author's abstract) W85-01632

IMPACT OF AN OIL FIELD EFFLUENT ON MICROBIAL ACTIVITIES IN A WYOMING

RIVER,
National Fishery Research Lab., La Crosse, WI.
M. A. Heitkamp, and B. T. Johnson.
Canadian Journal of Microbiology, Vol. 30, No. 6,
p 786-792, June, 1984. 2 Fig. 4 Tab, 19 Ref.

Descriptors: *Wyoming, *Little Popo Agie River, *Ecological effects, *Öil wastes *Öil fields, *Microbial studies, Hydrocarbons, Wastewater pollution, Species composition, Sediments, Water pollution effects.

The survival, functions, and physiological diversity of autochthonous sediment microbiota were examined in situ at five stations along the Little Popo Agie River, WY; one station above, one at, and three below a discharge point for oil wastewater from Union Oil Company's Dallas Field. Below the oil wastewater discharge point there were increases in electron-transport activity, carbon dioxide production, and microbial populations of heterotrophs, ammonifiers, hexadecane degraders, starch hydrolyzers, protein hydrolyzers, and sulfate reducers. At a station 1420 m below the discharge point, however, overall sediment microbial fate reducers. At a station 1420 m below the discharge point, however, overall sediment microbial activities and all of the physiological groups of bacteria, except hexadecane-degrading microbiota, were at levels comparable with those at the control station above the discharge point. Similarly, mineralization of glucose, amino acids, hexanoic acid, and hexadecane was elevated at stations directly below the discharge point, but appeared to subside rapidly. Xenobiotic biodegradation potential of the sediments varied with the chemical and the sample location and was not directly related to oil residue levels in the sediment. Microorganisms thus appeared to maintain physiological diversity and increased in numbers and activity in a riverine environment that contained petroleum hydrocarbon concentrations known to be deleterious to freshwa-

ter fish and macrobenthic communities. (Author's abstract) W85-01640

ACID PRECIPITATION AND SCIENTIFIC UN-CERTAINTY PROBLEMS IN PROBABILITY, Vermont Law School, South Royalton. Environntal Law Center

F. C. Reed. International Journal of Environmental Studies, Vol. 18, No. 2, p 77-84, 1982. 2 Fig, 60 Ref.

Descriptors: *Acid rain, *Ecosystems, *Environmental effects, Fuels, Public opinion, Education, Power plants, Industrial wastes.

Acid precipitation, for the purposes of this study, refers to man made acid precipitation resulting from fossil fuel combustion by power plants, automobiles, smelters and refineries. Through a series of logical steps and questions, various generally accepted facts about acid precipitation are presented. The burning of fossil fuel has produced acid rain at levels sufficient to allow rainfall to reach a very low pH in many global areas. This low pH rainfall contributes to changes in man-made areas and natural areas. The extent to which these changes are attributable to man-made acid rain is not easily separated from other man-made or nature. changes are attributable to man-made acid rain is not easily separated from other man-made or natural inducers of change. The best attack on curing the problem is to treat the source, fossil fuel burning. Remedices such as lake liming, acid resistant fish breeding programs, genetic engineering programs to give species adapted to acid conditions, are at best only stop-gap measures. (Baker-IVI) W85-01665

ECONOMICS OF ACID RAIN: AN INVISIBLE HAND OF CONTROL,
Vermont Law School, South Royalton. Environmental Law Center.
A. H. Giller.

A. H. Gilbert.

International Journal of Environmental Studies Vol. 18, No. 2, p 85-90, 1982. 1 Fig, 18 Ref.

Descriptors: *Acid rain, *Economic analysis, *Electric power costs, Costs, Economic aspects, Air pollution, Electric power production.

Economics currently plays an insignificant role in the control of acid rain. Economists have fallen into the old familiar pattern of evaluating the im-pacts of acid rain instead of developing economic pacts of acid rain instead of developing economic techniques for controlling the source of its emission. Power generating plants and other major producers of acid rain discharge their oxide wastes into the air in order to reduce production costs. This cost saving enables the producer to increase profits and expand production at the expense of those who suffer from acid rain. The solution to this misallocation requires the internalization of all this misallocation requires the internalization of all production costs. The price of the product will then reflect its true cost. Acid rain will be eliminated and resources will be more efficiently allocated. Economists will not have to attempt to evaluate the impossible nor trace its untraceable origin. Acid rain will no longer threaten our survival. (Author's abstract)

W85-01666

POLLUTION EFFECTS MONITORING WITH FORAMINIFERA AS INDICES IN THANA CREEK, BOMBAY AREA,

National Inst. of Oceanography, Panaji (India). M. G. A. P. Setty.

International Journal of Environmental Studies, Vol. 18, No. 3/4, p 205-209, 1982. 1 Fig. 1 Tab, 5

Descriptors: *Thana Creek, *Bombay, *India, *Foraminitera, *Bioindicators, *Water pollution effects, Protozoa, Benthic fauna, Benthos, Aquatic

Thana Creek, which flows through Bombay, India, into the Arabian Sea, has a very low fresh water inflow. The creek's temperature, salinity, depth, and tidal range are drastically affected by heavy discharges of effluents from factories located on

either side of the creek. Benthonic foraminifera in sediments from the most upstream sampling stations are very small, embryonic and dull, and appear to be highly corroded having a very low (5-10 taxa in 1 gram dry weight sediment) distribution. The species diversity and the total foraminiferal number is high at the lower stations, compared to the upper stations, and include both embryonic and adult forms. Ostracoda are rare at the most upstream station and are common at the down stream stations. In the study area, the pollution effect on the foraminiferids is intense, hence highly reliable and measurable. The relative sensitivity of tolerance of the biota is sharply variable and dependent upon the nature of the pollutants discharged. The degree of pollution of this environment can be monitored through delineation of zones of effects of pollution. (Collier-IVI)

INFLUENCE OF PHYSICO-CHEMICAL FAC-TORS ON THE COLIFORM BACTERIA IN A CLOSED-LAKE WATER SYSTEM, Jawaharial Nehru Univ., New Delhi (India). Mi-

crobiological Lab.

For primary bibliographic entry see Field 2H. W85-01672

GEOCHEMISTRY OF WELL WATER AND CARDIOVASCULAR DISEASES IN SRI

LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Geology.
C. B. Dissanayake, A. Senaratne, and S. V. R.

Weerasooriya. International Journal of Environmental Studies. Vol. 19, No. 3/4, p 195-203, 1982. 9 Fig, 1 Tab, 10

Descriptors: *Sri Lanka, *Cardiovascular diseases, *Geochemistry, *Well water, Hardness, Epidemiology, Public health, Hypertensive diseases, Trace

Clear correlations between water hardness and heart diseases have been observed in many counheart diseases have been observed in many coun-tries. A survey carried out on the incidence of cardiovascular diseases in Sri Lanka in relation to the hardness of drinking water reveals that a corre-lation exists which is geographically related. There is a broad correlation indicating a low incidence of cardiovascular diseases when the water hardness reaches appreciable values. A clear-cut association cannot be expected, since other factors also appear to be involved. A case in point are the high hyper-tensive diseases and death rates in the North Cen-tral Province, even though the water hardness is tensive diseases and death rates in the North Central Province, even though the water hardness is high enough to prevent such a high incidence. The broad correlation cannot be considered as a causal relationship and other factors possibly exist that could also play a major role in the incidence of cardiovascular diseases, e.g. type and quantity of trace elements in the water. (Collier-IVI) W85-01674

DISTRIBUTION AND PERIODICITY OF TOTAL, FAECAL COLIFORM BACTERIA IN AN AQUATIC ECOSYSTEM,

Jawaharlal Nehru Univ., New Delhi (India). Mi-crobiological Lab.

For primary bibliographic entry see Field 5B. W85-01675

MODELING ALGAL BEHAVIOUR IN THE

RIVER THAMES, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 5G. For primar W85-01720

GROWTH OF CLADOPHORA GLOMERATA IN A RIVER RECEIVING SEWAGE EFFLUENT,

ern Water Authority, Chatham (England). Kent Div. J. R. Wharfe, K. S. Taylor, and H. A. C.

Montgomery. Water Research, Vol. 18, No. 8, p 971-979, 1984. 5 Fig, 3 Tab, 12 Ref.

Effects Of Pollution—Group 5C

Descriptors: *River Great Stour, *England, *Cladophora, *Phosphorus, Effuents, Water pollution effects, Limiting nutrients, Aquatic plants, Wastewater treatment, Phosphorus removal.

The River Great Stour is one of the principal rivers in Kent, England and provides a valuable fishery and amenity asset. There was a deterioration of the flora in the 1950s, with dense growths of Cladophora and the disappearance of some rooted macrophytes. A considerable improvement in the natural flora of the River Great Stour has occurred since the mid-1960s when a new sewage treatment works was commissioned at Ashford. A treatment works was commissioned at Ashford. A vegetation mapping program undertaken from 1978 to 1982 to assess the influence of the sewage treatment works discharge on the growth of the filamentous alga. Observation on the growth of Cladophora in the river suggest that dissolved phosphorus concentration are not normally limiting, especially as vigorous growths occurred on some occasions at location upstream from the sewage treatment works discharge. Previous recommendations to reduce dissolved phosphorus concentrations in the final effluent of the Ashford facility need not be implemented. The amenities of the river will be better preserved by maintaining the present practices in weed cutting and by conthe present practices in weed cutting and by continuing to provide a high standard of conventions treatm at Ashford sewage treatment works.

TOXICITY OF CHLORINE TO A COMMON VASCULAR AQUATIC PLANT, National Park Service, Washington, DC. Ecologi-

C. H. Watkins, and R. S. Hammerschlag.
Water Research, Vol. 18, No. 8, p 1037-1043, 1984.
3 Fig. 3 Tab, 19 Ref.

Descriptors: *Myriophyllum, *Chlorine, *Phytotoxicity, Aquatic plants, Chlorophyll a, Effluents, Chlorination, Water pollution effects.

Myriophyllum spicatum was exposed to various chlorine concentrations on a continuous and intermittent basis in 96-h toxicity studies utilizing a proportional diluter. Continuous exposure to chlorine concentrations as low as 0.05 mg/l total residual chlorine (TRC) depressed shoot and total plant dry weights approx. 30% relative to controls. Shoot length was depressed approx. 16% at this concentration. Chlorophyll a was depressed 25% at 0.1 mg/l TRC. However, intermittent exposure of plants to chlorine for three 2-h periods daily for at 0.1 mg/l TRC. However, intermittent exposure of plants to chlorine for three 2-h periods daily for 96 h indicated an insensitivity to repeated short term chlorine exposure at all concentrations but 1.0 mg/l TRC. These results indicate that high level chlorine discharges from waste water facilities and electric generating plants could be a contributing factor impacting nearby submerged aquatic vegetation. (Author's abstract) W85-01731

OCCURRENCE OF THE ASIATIC CLAM CORBICULA FLUMINEA IN THE MAUMEE RIVER AND WESTERN LAKE ERIE,

Toledo Edison Co., OH.
J. Scott-Wasilk, G. G. Downing, and J. S.

Journal of Great Lakes Research, Vol. 9, No. 1, p 9-13, 1983. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Corbicula, *Maumee River, *Lake Erie, *Thermal pollution, Clams, Powerplants, Heated water, Effluents, Ecological distribution, Biofouling.

Under certain conditions the Asiatic clam may pose a significant biofouling threat to powerplants due to colonization and subsequent blocking of raw water systems. Surveys of the occurrence of the clam were conducted in the thermal plumes of three electric generating facilities in western Lake Erie. The Asiatic clam was found in only two locations along the southern shore of the western basin of Lake Erie: the thermal plume areas of the two coal-fired power plants with once-through condenser cooling systems. Three sewage treat-ment plant outfalls were sampled, but Corbicula

were found only in the sewage treatment plant outfall that was within the thermal plume of a power plant. No Corbicula were found in the vicinity of the nuclear power plant which had a closed-cycle natural draft cooling tower, and hence no significant thermal plume. The oldest specimens are at least 3 yr old, indicating that the clam probably has been established in in the region since 1978. The Great Lakes are farther north than the natural range of this clam, and prolonged cold temperatures in this region may be responsible for the confinement of this clam to baseload power plants with continuous thermal plumes. Those incustries or municipalities which have a continuous discharge of water which is always above 4.5 C may find it useful to determine if the clam is present in their plume areas. (Moore-IVI)

ACCUMULATION OF THE TRACE ELE-MENTS LEAD AND ZINC BY ASELLUS COM-MUNIS AT THREE DIFFERENT PH LEVELS, Rutgers - The State Univ., New Brunswick Dept. of Environmental Science. For primary bibliographic entry see Field 5B. W85-01795

RESPONSE OF ALGAL POPULATIONS TO CHANGES IN STREAM WATER QUALITY, Rutgers - The State Univ., New Brunswick, NJ. Dept. of Biological Sciences. F. B. Trama.

F. B. Trama.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202464, Price codes: A02 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies Completion Report, February 1984. 15 p., 5 Fig. 7 Tab, 11 Ref. Project No. OWRT A-061-NJ(1), Contract/Grant No. 14-34-0001-1132.

Descriptors: *Bioassay, *Selenastrum, Eutrophica-tion, Streams, Stream pollution, *Algal assay, Dial-ysis cells, Semipermeable membranes, *Biomoni-toring, *Chlorophyta.

A custom-made dialysis cell and a commercially available clear plastic chamber (Biomonitor) with a semipermeable membrane were tested as potentially more useful and reliable than the closed flasks employed in the widely adopted EPA Algal Assay: Bottle Test procedure. The dialysis cell failed to attain equilibrium with an external medium within a 60 hour period. The Biomonitor attained equilibrium within 60 hours but not with respect to soluble inorganic phosphorus. The growth response of natural plankton or a green alga, Selanastrum capricornutum, in Biomonitors under laboratory and in situ conditions showed that the Biomonitor produced results which were more variable and erratic than those obtained using a modified Algal Assay: Bottle Test procedure. Use of chlorophyll a to estimate algal biomass increased the variance by an order of magnitude in comparison to estimates from cell counts and mean cell volumes. Biomonitors proved to be more costly to use, less reliable, and subject to greater variation than the closed flask procedure. No significant improvement was found by employing semipermeable test chambers under laboratory or field conditions when compared to results from the modified EPA Algal Assay: Bottle Test procedure. W85-01797

ANALYSIS OF POLLUTANT ENHANCED BACTERIAL BLUE-GREEN ALGAL INTERRE-LATIONSHIPS POTENTIATING SURFACE WATER CONTAMINATION BY BLUE-GREEN ALGAL BLOOMS, Nevada Univ., Reno. Dept. of Biology. G. W. Bedell.

G. W. Bedell.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-202498,
Price codes: A02 in paper copy, A01 in microfiche.
Water Resources Center Completion Report, February 1984. 10 p, 1 Tab, 8 Ref. Project No. OWRT
A-102-NEV(1), Contract/Grant No. 14-34-0001-2130.

Descriptors: *Algae, Bacteria, *Sulfur bacteria, *Eutrophication, Reservoirs, Alkaline water, Cyanophyta, Anabaena, Desulfovibro.

Sulfate-reducing bacteria from the genus Desulfo-vibro can stimulate the blue-green alga (Cyanol-va-terium) Anabaena variabilis (Strain 6411) into in-creasing its dry weight biomass production by more than 200 percent over that of the control as the total phosphate in the medium approaches zero. Methods which utilize total nitrogen to phos-phorus ratios in waters as predictors of blue-green algal 'blooms' may be unreliable when the waters are very low in phosphorus yet remain high in sulfate with conditions favorable for sulfate-reduc-ing bacterial growth in benthic sediments. In high sultate with conditions favorable for sulfate-reducing bacterial growth in benthic sediments. In high sulfate containing waters that are alkaline and that are low in both nitrogen and phosphate, blue-green algal blooms will prevail unless some steps are taken to control the growth of the bacteria. Otherwise, if the phosphate levels alone in the aqueous systems are reduced below threshold levels under these conditions, the magnitude of the blue-green these conditions, the magnitude of the blue-green. systems are reduced below threshold levels under these conditions, the magnitude of the blue-green algal blooms may be increased substantially. These data should be considered by those who will be making policy at the federal, state, or local levels, regarding the total removal of phosphorus from wastewaters or from certain aqueous systems. The data may be important for considering the effects of acid rain as well. W85-01803

INFLUENCE OF ACID PRECIPITATION ON STREAM INVERTEBRATES,
Michigan State Univ., East Lansing. Dept. of Zo-

ology.
T. M. Burton, and J. W. Allan.

Available from the National Technical Information Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190073, Price codes: A03 in paper copy, A01 in microficher, Institute of Water Research Completion Report, September, 1983. 25 p, 4 Fig, 4 Tab, 19 Ref. Project No. OWRT A-120-MICH(1), Contract/ Grant No. 14-34-001-2124.

Descriptors: *Invertebrates, Caddisflies, Isopods, Snails, Stoneflies, Acid streams, *Aluminum, *Toxicity, Asella, Lepidostoma, Pycnopsyche, Physa, Nemoura, *Acid rain, Water pollution ef-fects, *Hydrogen ion concentration.

Five species of invertebrates, Asellus intermedius an isopod, Lepidostoma liba and Pycnopyche sp., two species of caddisflies, Physa heterostropha, a snail, and a Nemoura sp., a stonefly, were tested for 30 days in 5 separate experiments for susceptibility to acidification to pH 4.0 and pH 5.0 alone or in combination with 250 to 500 micrograms Al/1. The effects of organic matter on the susceptibility of these invertebrates to acidification and aluminum toxicity were also tested. Acidification alone of natural stream water to pH 4.0 resulted in aignificant mortality for all 5 species. The addition of 500 micrograms Al/1 significantly increased this mortality. Experiments with distilled water with morganic chemistry adjusted to simulate natural Five species of invertebrates, Asellus intermedius inorganic chemistry adjusted to simulate natural stream water demonstrated that the absence of organic matter strongly resulted in much greater aluminum toxicity at low pH's and in somewhat greater susceptibility to acidification alone. The addition of citrate as an organic ligand decreased this effect. Experiments conducted at pH 5.0 with 250 micrograms Al/1 added to natural stream water demonstrated that no significant mortality occurred. Thus, acidification effects for these 5 peocles for 30 days average section and organic matter strongly resulted in much greater species for 30-day exposure periods only occurred at pH levels less than pH 5 and at aluminum levels greater than 250 micrograms Al/l. The threshold for effects, thus, was between pH 5 and pH 4 and between 250 and 500 micrograms Al/l. W85-01807

EFFECTS OF THE HERBICIDE ATRAZINE ON AN OYSTER-FOOD ORGANISM,

Maryland Univ., College Park. Dept. of Botany. E. P. Karlander, J. M. Mayasich, and D. E.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-190172, Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center Pub-lication No. 73, August 1983, 20 p, 3 Tab, 35 Ref. Project No. OWRT A-060-MD(1), Contract/ Grant No. 14-34-0001-2122.

Group 5C-Effects Of Pollution

Descriptors: *Triazine pesticides, *Temperature, *Light intensity, *Herbicides, *Atrazine, Oysters, Algae, *Growth rates, Phytoplankton, Algal growth, Chesapeake Bay, *Maryland, Agricultural runoff, *Nannochloris oculata, Frish food orga-

Growth rates of semicontinuous cultures of Nannochloris oculata (Chesapeake Bay clone) were determined in repeated experiments each featuring 27 treatment combinations of temperature, light, and the herbicide atrazine. All interactions two ways and three-ways were significant. This indicate and the hericide atrazine. All interactions two-way and three-way, were significant. This indicat-ed the main effects did not act independently to produce the response for a given treatment. Fur-ther analysis of the interactions showed that they were largely linear in nature. Atrazine's toxicity was maximized when temperature and light condi-tions were optimal for rapid growth. The percent inhibition for atrazine at 100 ppb ranged from 46.2% at low temperature (15 C) and low light (0.208 mW/cm) to 54% at high temperature (25 C) and high light (1.352 mW/cm). The dependency of atrazine's toxicity on temperature and light stresses the need for incorporating these and other impor-tant environmental variables into future laboratory and field studies which investigate the effects of herbicide runoff on non-target organisms in the herbicide runoff on non-target organic Chesapeake Bay. W85-01808

EFFECTS OF RUNOFF FROM UNDEVEL-OPED VERSUS LIGHTLY DEVELOPED WA-TERSHEDS ON TROPICAL PLANKTONIC

Caribbean Research Inst., St. Thomas, VI.
T. W. Purcell, III, and M. J. Canoy.
Technical Report No. 17, September 1983. 56 p, 2
Append. Project No. OWRT A-013-VI(1), Contract/Grant No. 14-34-0001-1150.

Descriptors: Runoff, Tropical waters, Plankton, *Marine water quality, Mangroves, *Virgin Is-lands, St. Thomas, Watershed development, Eco-logical impact, Water pollution control, Great Cruz Bay.

Two watersheds on the island of St. Thomas were studied to determine the effects of development on the quality of runoff water into the bays and to assess the effects of this runoff on the bay waters assess the effects of this runon on the commu-and plankton communities. The plankton commu-nities studies were phytoplankton, zooplankton, and Ichthyoplankton. It was found that PO4 and NO3 were key nutrients, and turbidity a limiting physical effect. These, where they reached the bays, had a notable but not direct effect on the plankton production and dynamics. A key element in controlling the effect was whether or not the normal salt pond mangrove system was left intact. W85-01810

LIMNOLOGY IN RESERVOIRS ON THE COL-ORADO RIVER,

Nevada Univ., Las Vegas. Lake Mead Limnologi-cal Research Center. ary bibliographic entry see Field 2H.

POTENTIAL FOR ACIDIFICATION OF SIX REMOTE PONDS IN THE WHITE MOUN-TAINS OF NEW HAMPHIRE, Northeastern Forest Experiment Station, Durham, NH.

For primary bibliographic entry see Field 5B. W85-01834

EFFECTS OF AMMONIUM EFFLUENTS ON PLANKTONIC PRIMARY PRODUCTION AND DECOMPOSITION IN A COASTAL BRACKISH WATER ENVIRONMENT. I. INTERRELATIONS BETWEEN ABIOTIC AND BIOTIC COMPONENTS OF THE PLANKTONIC ECO-

Helsinki Water District (Finland) T. Tamminen

Netherlands Journal of Research, Vol. 15, No. 3/4, p 349-361, December, 1982. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Water pollution effects, *Ammoni-um, *Estuaries, *Finland, *Baltic Sea, Ecosystems, Plankton, Chlorophyll, Primary productivity, Brackish water, Heterotrophic activity.

The study area was located at the southern coast of Finland, the Baltic Sea. Interactions between abiotic and biotic components of the planktonic ecosystem in the ammonium-loaded archipelago area were studied. Gradients of chlorophyll a, primary productivity and heterotrophic activity evolved around the discharge site. Multivariate analyses described typical stages in the succession of the planktonic community. A proposured between planktonic community. A pronounced heterotro-phic phase was observed, which referred especially pnus phase was observed, which referred especially to the innermost research area. Since acute stimulations of heterotrophic activity were observed only exceptionally in effluent tests, planktonic and benthic primary production and sediment metabolism were considered as mediators of effluent effects on heterotrophy. (Baker-IVI) W85-01840

ANNUAL CYCLE OF KEPONE RESIDUE AND LIPID CONTENT OF THE ESTUARINE CLAM,

LIPID CONTENT OF THE ESTUARINE CLAM, RANGIA CUNEATA, Virginia State Water Control Board, Richmond. Div. of Ecological Studies. C. A. Lunsford, and C. R. Blem. Estuaries, Vol. 5, No. 2, p 121-130, June, 1982. 5 Fig. 4 Tab, 17 Ref.

Descriptors: *Kepone, *Lipids, *Clams, *Rappa-hannock River, *James River, *Virginia, Water pollution effects, Pesticides, Salinity, Hydrogen ion concentration, Water temperature.

Factors affecting Kepone uptake and lipid content of the clam, Rangia cuneata, were tested over a 12 month study. Clams obtained from the Rappahanmonth study. Clams obtained from the Rappahan-nock and James Rivers were held in submersible live boxes at two sites in the James River estuary and were sampled monthly from September 1978 through August 1979. Clams held in the freshwater zone near the source of Kepone contamination (Hopewell, Virginia) generally had higher Kepone and lipid content than those held downstream in the oligohaline zone. Significant differences in largely, but not entirely, a function of ambient water temperature, dissolved oxygen, amount of lipid in the clam, turbidity, Kepone content of the water column and duration of exposure. Lipid water column and duration of exposure. Lipid content of clams varied significantly between test sites, river of origin and months and is significantly related to salinity, ambient water temperature, pH and duration of exposure. Kepone content was more closely correlated with total lipid stores of clams than any other real variable. This association may be due to lipid reserves acting as a storage site for Kepone, but may also be interpreted as the result of selection against clams lacking lipid stores that might act as reservoirs for Kepone thus protecting more delicate tissues. (Author's abstract) W85-01844

RESPONSES OF DEVELOPING ESTUARINE MACROBENTHIC COMMMUNITIES TO DRILLING MUDS,

Environmental Research Lab., Gulf Breeze, FL. M. E. Tagatz, J. M. Ivey, C. E. DalBo, and J. L. Oglesby.

Oglesby.

Estuaries, Vol. 5, No. 2, p 131-137, June, 1982. 2

Fig. 3 Tab, 18 Ref.

Descriptors: *Benthic animals, *Estuarine environment, *Drilling muds, Water pollution effects, Zooplankton, Tunicates, Mollusks, Annelids, Constitution

The effects of drilling mud, used in oil drilling operations, on development of estuarine macro-benthic communities from settling planktonic bentine communities from setting plantfornic larvae were assessed by comparing numbers and species of animals that grew in uncontaminated and contaminated aquaria for 8 weeks. Aquaria contained sand and were continuously supplied unfiltered seawater. Seven lignosulfonate-type drilling muds obtained from an active exploratory platform in estuarine waters were tested consecutively at nominal concentrations of 0.5, 5, and 50

parts per million (ppm) in the water column. Numbers of tunicates, mollusks, and annelids per aquarium were significantly (alpha = 0.05) decreased from control numbers in 50 ppm. Structural differences in communities exposed to 50 ppm from those in the control and lower concentrations were indicated by a decrease in Spearman's measure of rank correlation of species abundance and an increase in the Shannon-Weaver index of species diversity. A total of 13 species occurred in 50 ppm compared to 23 species in each of the other situations. Growth in diameter of Molgula manhattensis was significantly affected in all concentrations of mud. (Author's abstract)

ACUTE TOXICITY OF KEPONE TO SELECTED FRESHWATER FISHES.

Virginia Inst. of Marine Science, Gloucester Point. M. H. Roberts, Jr., and R. E. Bendl. Estuaries, Vol. 5, No. 3, p 158-164, September, 1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Kepone, *Pesticide toxicity, *Fish, *James River, *Virginia, Toxicity, Eel, Elvers, Immature growth stages, Catfish, Bluegill, Bioactures the complete of the co

e maximum concentration of a compound which can occur dissolved in water without causing long-term effects for various species, called the maximum acceptable toxicant concentration (MATC), can be estimated for the 96-h LC50 if the (MA IC) can be estimated to the 9-bit 1253 it the application factor is known for at least one species. The acute toxicity of Kepone in freshwater was determined with three fish species occurring in the James River; Ictalurus punctatus (channel catfish), Lepomis macrochirus (bluegills), and Anguilla rostrata (American eel). Elvers of A. rostrata were trata (American eel). Elvers of A. rostrata were most sensitive with a 96 h lethal concentration for 50% of the animals tested (LC50) of 35 micro g per l. Bluegills were slightly less sensitive with a 96 h LC50 of 514 micro g per l. Catfish were most tolerant with a 96 h LC50 of 514 micro g per l. Bluegills and catfish exposed to comparable concentrations of Kepone accumulated equivalent amounts in 96 h. Using an application factor of 0.004, the calculated MATC's for elvers, bulegills, and channel catfish are estimated to be 0.14, 0.20, and 2.0 micro g per liter or above, respectively. These values are all well above the 5 ng per l observed in water samples for the James River near Skiff's Creek. (Moore-IVI)

DEVELOPMENT OF THE CONDITION OF THE BALDEGGERSEE (1900 TO 1980) AND THE EFFECT OF INTRALAKE PROCEDURES (DIE ZUSTANDSENTWICKLUNG DIS BAL-DEGGERSEES (1900 BIS 1980) UND DIE AU-WIRKUNG VON SEEINTERNEN MASSNAH-

P. Stadelmann. Wasser, Energie, Luft, Vol. 76, No. 5/6, p 85-95, 1984. 15 Fig, 7 Tab, 70 Ref.

Descriptors: *Baldeggersee, *Switzerland, *Eutro-Decariptons: Daueggerisec, Switzeriand, Editro-phication, Fish, Phytoplankton, Destratification, Lake restoration, Fishkills, Supersaturation, Dis-solved oxygen, Limnology, Aeration, Water circu-lation, Aerobic conditions.

The eutrophication of the Baldeggersee in Switzerland is demonstrated by changes in the fish and phytoplankton populations and by the results of limnological studies. In 1900, the lake was oligoinmological studies. In 1900, the lake was oligo-trophic and contained many fish. By 1940, carp were the predominant species of fish. Since the 1950s, episodes of fish mortality have demonstrat-ed oxygen supersaturation in the surface layer of ed oxygen supersaturation in the surface layer of the lake and oxygen deprivation in the depths. Oscillatoria rubescens was predominant from 1900 to 1965 but disappeared with increasing eutrophi-cation. Eutrophication reached a maximum around 1975. Phosphorus concentration in spring reached 500 mg total P/cu m, and primary production was 420 g C/sq m/yr. Increased levels of ammonium, sulfide, methane, and manganese were found in the hypolimnion. External measures were able to reduce phosphorus input only by 50% and at too

Effects Of Pollution—Group 5C

slow a rate. Artificial circulation of the lake in winter to achieve destratification and oxygen aerwinter to achieve destratification and oxygen aeration in summer were therefore carried out. The first artificial circulation was performed in February 1982 and lasted 2 mc, after 2 wk, an even distribution of temperature and oxygen was achieved. Sulfide disappeared in deep water after the first circulation. The introduction of 4.5 tonnes 02/day into deep water in summer 1983 resulted in aerobic conditions year-round throughout the entire lake. In fall, the highest oxygen levels ever recorded were found. Sulfide and methane could not be measured, and ammonium and manganese were found in lower concentrations. External procedures brought phosphorus input down to 250 mg/cu m the following spring. (Gish-IVI) W85-01865

EFFECTS OF THE HERBICIDE ATRAZINE ON ADENINE NUCLEOTIDE LEVELS IN ZOSTERA MARINA L. (EELGRASS),

MERINA L. (EELGRASS), Virginia Inst. of Marine Science, Gloucester Point. D. A. Delistraty, and C. Hershner. Aquatic Botany, Vol. 18, No. 4, p 353-369, June, 1984. 9 Fig. 4 Tab, 32 Ref. EPA grants R805953 and X003245.

Descriptors: *Adenine nucleotides, *Eelgrass, *Atrazine, *Phytotoxicity, Water pollution effects, Herbicides, Adenylates, Productivity, Plant physiology, Macrophytes.

Response of adenine nucleotides (ATP, ADP, AMP) and adenylate energy charge (EC) to atrazine, a triazine herbicide, was evaluated as an indicator of metabolic state in Zostera marina L. indicator of metabolic state in Zostera marina L. (eelgrass), a submerged marine angiosperm. Shorterm (6 h) atrazine stress reduced ATP and total adenylates (AT) at both 10 and 100 ppb, but EC remained constant. Net productivity decreased at 100, but not at 10 ppb atrazine over 6 h. Long-term (21 day) atrazine stress was evidenced by growth inhibition and 50% mortality near 100 ppb. EC was reduced at 0.1, 1.0 and 10 ppb atrazine, but ATP, and EC increased with physiological response to severe stress (100 ppb) after 21 days. Apparently, ATP and AT decrease over the shorterm but rebound over the long-term with severe atrazine stress, increasing beyond control levels before plant death results. Supplementing adenine nucleotide and EC results with more conventional quantitative analyses should afford greater knowledge of physiological response to environmental variation. Author's abstract)

IMPACT OF ACIDIFICATION AND EUTRO-PHICATION ON MACROPHYTE COMMUN-ITES IN SOFT WATERS, II. EXPERIMENTAL

STUDIES, Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
J. G. M. Roelofs, J. A. A. R. Schuurkes, and A. J.

M. Smits.

Aquatic Botany, Vol. 18, No. 4, p 389-411, June, 1984. 9 Fig, 10 Tab, 27 Ref.

Descriptors: *Acidification, *Eutrophication, *Macrophytes, *Soft water, *Netherlands, Nutrients, Aquatic plants, Phosphates, Nitrogen, Carbon dioxide, Alkalinity, Ammonium.

In The Netherlands, there has been a dramatic decline during the last 30 years in the number of stands belonging to the phytosociological alliance Littorellion. Generally, the communities classified within this alliance occur in poorly buffered, oligorophic unsteas with your low becaute the states. trophic waters, with very low phosphate, nitrogen and carbon dioxide levels in the water layer and considerably higher nutrient levels in the sediment. The plant species dominating these communities are isoetid such as Littorella uniflora (L.) Aschers, Lobelia dortmanna L. and Isoetes lacustris L., which show various adaptations to make successful growth possible under these conditions. successful growin possible under these conditions. Field observations showed that the waters where Littorella uniflora had disappeared or strongly decreased could be divided into two groups. A major group (77%) was characterized by the presence of submerged Juncus bulbosus L. and/or Sphagnum species. These waters appeared to be strongly

acidified (pH < 4.5) and had increased nitrogen levels with ammonium as the dominant N-source. Within this group, the waters with luxuriant growth of J. bulbosus and/or Sphagnum spp. had strongly increased carbon dioxide levels in both sediment and water. Different types of experiments proved casual relationships between the observed changes in macrophytes and the changed physicochemical parameters. Ecophysiological experiments showed that J. bulbosus lacks the typical adaptations of the isoetid plant species, i.e. it uses very low amounts of sediment-CO2 and releases only a little oxygen from the roots. However, J. bulbosus is more able than Littorella unifora to use CO2 from the water layer. From the nutrientvery low amounts of sectiment-CO2 and releases only a little oxygen from the roots. However, J. bulbosus is more able than Littorella uniflora to use CO2 from the water layer. From the nutrient-uptake experiments, the decreased nitrate and increased ammonium levels seem to be favorable to J. bulbosus. The culture experiments clearly demonstrated that the biomass of J. bulbosus only increased strongly when the sediment was poorly buffered and the pH of the water was low. When combining factors like CO2 enrichment of the sediment, with and without phosphate, and/or ammonium enrichment of the water in the culture experiments, it is clearly shown that phosphate and/or ammonium enrichment without CO2 enrichment do not lead to an increase in biomass of J. bulbosus. Therefore, it is obvious that the changes in the macrophyte community can be ascribed primarily to changes in the carbon budget as a result of acidification. A minor group of waters (23%) was characterized by the absence of submerged J. bulbosus and/or Sphagnum spp. In most of these waters, submerged plant species occurred, such as Myriophyllum alterniflorum DC or non-rooted species such as Riccia fluitans L. These waters were not acidified, and generally had an increased alkalinity and higher nitrogen and phosphate levels of sediment and/or water. Culture experiments showed that phosphate enrichment of both sediment and water leads to mass development of non-rooted plant species such as R. fluitans. (Author's abstract) W85-01889

TROPHIC RESPONSE OF FISHES TO HABI-TAT VARIABILITY IN COASTAL SEAGRASS SYSTEMS, Florida State Univ., Tallahassee. Dept. of Biologi-

cal Science.

For primary bibliographic entry see Field 2L. W85-01890

TERRESTRIAL RUNOFF AS A CAUSE OF OUTBREAKS OF ACANTHASTER (ECHINODERMATA; ASTEROIDEA),

Guam Univ., Agana. Marine Lab. C. Birkeland. Marine Blology, Vol. 69, No. 2, p 175-185, August, 1982. 2 Fig, 4 Tab, 75 Ref.

Descriptors: *Runoff, *Acanthaster, *Marine environment, *Phytoplankton, Eutrophication, Typhoons, Drought, Guam, Micronesia, Polynesia, Nutrients, Bays, Rainfall.

Outbreaks of adult Acanthaster planci (Linns Outbreaks of adult Acanthaster planci (Linnaeus) have appeared at irregular intervals, arriving 3 yrs after heavy rains (> 100 cm in 3 months) following droughts (< 25 cm in 4 months) or 3 yrs after rains exceeding intensities of 30 cm in 24 h. Outbreaks of A. planci follow 'tphoons that bring heavy rains, but do not follow 'dry' typhoons of equivalent wind force. Outbreaks occur around the high islands in Micronesia and Polynesia, but not cround the stells at intermediate locations. Phytohigh islands in Micronesia and Polynesia, but not around the atolis at intermediate locations. Phytoplankton blooms appear off high islands at the beginning of the rainy season in bays with large watersheds and with sufficient residence time of the waters: these are the initial sites of A. planci abundance on Guam. The spawning seasons of A. planci occur at the beginning of the rainy season on both sides of the equator. It is hypothesized that, on rare occasions, terrestrial runoff from heavy rains (following the dry season or a record drought) may provide enough nutrients to stimulate phytoplankton blooms of sufficient size to produce enough food for the larvae of A. planci. The increased survival of larvae results in an out-

break of adults 3 yrs later. This hypothesis can be tested by predicting future outbreaks. An outbreak of A. planci on Saipan in the summer of 1981 was predicted on the basis of heavy rains in August 1978. (Author's abstract) W85-01893

HEPATIC MIXED-FUNCTION OXIDASES IN CALIFORNIA FLATFISHES ARE INCREASED IN CONTAMINATED ENVIRONMENTS AND

BY OIL AND PCB INGESTION, Lawrence Livermore National Lab., CA. For primary bibliographic entry see Field 5A. W85-01894

ENVIRONMENTAL AND BIOCHEMICAL IN-VESTIGATION OF SOME EFFECTS OF OR-GANIC POLLUTION IN INNER OSLOFJORD,

Dunstaffnage Marine Research Lab., Oban (Scot-

J. Blackstock, and C. Filion-Myklebust. Marine Biology, Vol. 73, No. 2, p 155-163, 1983. 2 Fig, 5 Tab, 22 Ref.

Descriptors: *Oslofjord, *Norway, *Polychaetes, *Water pollution effects, Enzymes, Dissolved oxygen, Carbon, Nitrogen, Redox potential, Moni-toring, Organic compounds, Sediments, Fjords.

Coordinated environmental monitoring and bio-chemical studies of the polychaete Glycera alba (Muller) have been applied to the assessment of the impact of inputs of organically rich waste material into Inner Oslofjord. Six sampling stations at inter-vals of 5 km on a transect extending from Lysa-kerfjord, 5 km from Oslo harbor, to Vollengropen, a few kilometers from the Drobak sill were used in kerfjord, 5 km from Oslo harbor, to Vollengropen, a few kilometers from the Drobak sill were used in the investigation. Samples of water, sediment and biological material were collected from these sampling stations on one occasion, in September 1980. On the basis of dissolved oxygen content of the water column near the sediment surface, carbon and nitrogen contents and redox potential (Eh) in the sediments, the greatest impact of organic enrichment was found at Lysakerfjord. Localized variations in sediment condition were, however, pronounced in the transect. Maximal activities of 4 enzymes associated with energy-yielding metabolism were estimated in 7 to 11 individual G. alba from each sampling station. Relatively low activitively of the sampling station. Relatively low activities of the property of the sampling station. lism were estimated in 7 to 11 individual G. alba from each sampling station. Relatively low activities of the glycolytic enzyme phosphofructokinase in the group of G. alba from Lysakerfjord may constitute a biochemical response to the effects of organic enrichment in this area. In G. alba from the sampling station at Slemmestad, it is suggested that low phosphofructokinase and malate dehydrogenase activities may reflect a biochemical response to effects of readonismstly increasing westerness. genase activities may reflect a biochemical response to effects of predominantly inorganic waste material from a nearby cement factory. In groups of G. alba from 5 sampling stations, i.e., excluding Slemmestad, mean phosphofructokinase activity is correlated with redox potential at 4 to 5 cm depth in the sediments. The results are discussed with reference to earlier biological studies and it is shown that low phosphofructokinase activities are found in the groups of G. alba from those areas where low diversity of macrobenthic fauna have been reported. It is concluded that the changes in phosphofructokinase activity may consistently reflect effects of environment changes that are characteristically associated with inputs of waste material. (Author's abstract) W85-01896

IMPACT OF DOMESTIC SEWAGE POLLU-TION ON ENZYMATIC ACTIVITIES OF TWO PLANKTONIC COPEPODS (ACARTIA CLAUSI PLANTIONIC COPEPOUS (ACARTIA CLAUSI AND CENTROPAGES TYPICUS) (IMPACT D'UNE POLLUTION D'ORIGINE URBAINE SUR LES ACTIVITES ENZYMATIQUES DE DEUX COPEPODES PLANCTONIQUES (ACARTIA CLAUSI ET CENTROPAGES TYPI-

Centre Univ. de Luminy, Marseille (France). Lab d'Hydrobiologie Marine. D. Riviere, and P. Kerambrun.

Marine Biology, Vol. 75, No. 23-35, p 25-35, 1983. 10 Fig. 4 Tab. 28 Ref.

Group 5C-Effects Of Pollution

Descriptors: *Copepods, *Enzymes, *Wastewater pollution, *Water pollution effects, Marseille, France, Municipal wastes, Effluenta, Esterase, Aminopeptidase, Dehydrogenase.

The effect of urban pollution on the enzymatic activities of two copepod species, Acartia clausi and Centropages typicus, was studies in the Marseille area (main sewage output of Cortiou) from May 1980 through June 1981. By means of electrophoresis on polyacrylamide gel, activities of esterases, leucine aminopeptidase (LAP), malate dehydrogenase (MDH) and malic enzyme (ME) were studied. The results are based on 124 analyses of A. clausi and 127 of C. typicus. The zymograms revealed important changes in enzyme activities connected with pollution which were either qualitative or quantitative in nature; the most distinct and frequent changes were displayed by the esterases, whose general activity considerably decreased at the most polluted stations; also, the relative activity of the different esterase fractions changed, and certain fractions did not appear at all. Leucine aminopeptidase zymograms displayed little change; The effect of urban pollution on the enzymatic certain fractions did not appear at all. Leucine aminopeptidase zymograms displayed little change; those of MDH and ME often exhibited an addithose of MDH and ME often exhibited an additional fraction in the polluted area. The results clearly show the impact of urban pollution at the enzymatic level. The changes appear to be a physical pological response of the organisms to environmental conditions, and demonstrate the profound effects that an ecological perturbation can have on the physiology of organisms. (Author's abstract) W85-01898

EFFECTS OF COPPER AND CADMIUM ON GROWTH, SWIMMING AND PREDATOR AVOIDANCE IN EURYTEMORA AFFINIS (COPEPODA).

Rhode Island Univ., Kingston. Graduate School of

Oceanography. B. K. Sullivan, E. Buskey, D. C. Miller, and P. J. Ritacco

Marine Biology, Vol. 77, No. 3, p 299-306, December, 1983. 7 Fig, 3 Tab, 32 Ref.

Descriptors: *Behavior, *Copper, *Cadmium, *Copepods, *Toxicity, Swimming, Predation, Immature growth stages, Heavy metals, Computers.

In the aquatic environment, pollutants typically occur at concentrations well below levels which directly cause death of organisms. The sensitivity of swimming behavior and predator-escape responses of nauplii of the estuarine copepod Eurytemora affinis to sublethal doses of Cu and Cd was studied in laboratory experiments. A werage swimstanding the control of the mora affinis to sublethal doses of Cu and Cd was studied in laboratory experiments. Average swiming speed of the nauplii were observed using computer analysis of video recordings. The responsiveness to mechanical stimuli designed to minnic a predator was tested. The importance of the modified behaviors to the outcome of actual encounters with predators was evaluated by measurements undesting rates of one vertebrate and one cacounters with predators was evaluated by measuring predation rates of one vertebrate and one invertebrate predator on nauplii. Behavior was generally altered at metal doses below those affecting growth rates or survival of the copepods. Swimming velocities of Cu-dosed nauplii were different form controls at all concentrations of ferent from controls at all concentrations of Cu tested (10-50 micro g/l total Cu) after 24- to 48-h tested (10-50 micro g/1 total Cu) after 24- to 48-h exposure; the development rate of nauplii was significantly reduced only after 96 h at 25 micro g/1. The 96 h LC50 for Cu was approximately 30 micro g/1 Cu. Naupliar swimming velocity was also affected by Cd. Swimming speeds were reduced after 24 h at 130 micro g/1, the development was alowed after 48 h at 116 micro g Cd/1. The 96-h LC50 was > 120 micro g/1. Nauplii exposed to Cu for 24 h were generally hyperactive, a condition which could increase their encounter frequency with predators. Reduced numbers of escape responses of nauplii to a simulated predator were observed only after 48-h exposure to Cu. Feeding rates of non-doaed larval striped bass on dosed nauplii (24 h at 25 micro g Cu/1) were significantly higher than on control nauplii. Feeding rates of larval mysid shrimp were not higher on similarly dosed nauplii; 24 h exposure of nauplii to > 30 micro g Cu/1 did result in increased predation by mysids. (Moore-IVI)

LOGGING IMPACTS AND SOME MECHANISMS THAT DETERMINE THE SIZE OF SPRING AND SUMMER POPULATIONS OF COHO SALMON FRY (ONCORHYNCHUS KISUTCH) IN CARNATION CREEK, BRITISH COLUMBIA

Department of Fisheries and Oceans, Nas (British Columbia). Pacific Biological Station. J. C. Scrivener, and B. C. Andersen.

Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1097-1105, 1984. 7 Fig. 2 Tab, 33 Ref.

Descriptors: *Salmon, *Logging, *Environmental effects, *Fry, *Carnation Creek, *British Columbia, Water temperature, Freshets, Fish behavior, Debris, Growth, Fish migration.

Debris, Growth, Fish migration.

Natural patterns in emergence times, seaward movements, instream distributions, densities, and growth of coho salmon fry (Oncorhynchus kisuch) between March and September are contrasted with patterns observed during and after logging in the Carnation Creek watershed. After streamside logging in 1976-77, fry emerged up to 6 wk earlier and moved seaward more quickly than during years before logging. These observations are attributed to higher water temperatures during the winter and to emergence during a period of more frequent freshets. Increased fry movement from the stream could result in habitat being undertuilized. In sections affected by intense streamside logging, the deposition of 'fine' logging debris led to increased fry densities during the summers of 1977 and 1978. After major freshets in November 1978, which removed this fine debris and affected channel morphology in these sections, fry densities declined below those observed prior to logging. Growth rate of fry was inversely correlated with density in all stream sections. Growth rates, after correction for density, tended to be greater in all sections after the adjacent streamside was logged. Larger fry and more variable numbers of fry remained in the stream in September after greater in all sections after the adjacent streamside was logged. Larger fry and more variable numbers of fry remained in the stream in September after logging than before logging. Their increased size is attributed to the longer growing seasons. logging than before logging. Their increased size is attributed to the longer growing season afforded by earlier emergence. This complex of interacting factors determines the number and size of fry in autumn and it can influence the production of smolts the following spring. (Author's abstract) W85-01919

TOXICITY OF ORGANIC MIXTURES SATURATED IN WATER TO DAPHNIA MAGNA. EFFECT OF COMPOSITIONAL CHANGES,

Syracuse Research Corp., NY. Life and Environ-mental Sciences Div.

R. H. Sugatt, D. P. O'Grady, and S. Banerjee. Chemosphere, Vol. 13, No. 1, p 11-18, 1984. 4 Tab, 10 Ref. EPA Grant R8 086 13.

Descriptors: *Toxicity, *Solutions, *Organic compounds, *Daphnia, Water pollution effects.

The toxicity of aqueous solutions saturated with mixtures of hydrophobic organic liquids is contrasted to that of solutions prepared from solids. Data for a variety of mixtures are presented and are related to the solubilities of the components. The toxicities of compounds in liquid mixtures are influenced by the composition of the mixtures, whereas those of solids are relatively independent of composition. If biological interactions are neglected, then the toxicity of a component in a saturated liquid mixture will tend to be lowered by saturated liquid mixture will tend to be lowered by the presence of other less toxic components, and the toxicity of a saturated solution of the mixture will equal or be less than that of the corresponding white equal of the ress than that of the corresponding solution of its most toxic component. In contrast, the toxicity of a saturated solution derived from a mixture of solids will tend to equal or exceed that of a corresponding saturated solution of its most toxic component, and will tend to increase with the complexity of the mixture. These conclusions are broad generalities, incorporating numerous as-sumptions and should be used with caution. Never-theless, they do illustrate the utility of simple phys-icochemical relationships in environmental hazard assessment. (Baker-IVI)

ANALYSIS OF AQUATIC TOXICITY DATA: WATER SOLUBILITY AND ACUTE LC30 FISH

W. B. Neely. Chemosphere, Vol. 13, No. 7, p 813-819, 1984. 1 Fig, 2 Tab, 15 Ref.

Descriptors: *Organic compounds, *Solubility, *Fish, *Toxicity, Water pollution effects.

A theoretical relation has been established between the water solubility of an organic chemical and the ratio of the acute fish LC50 at two different time periods. The theory was tested by examining a data base of 24 chemicals. The finding of a positive correlation between the observed and calculated ratio of the 96 hr LC50 to the 24 hr LC50 helped ratio of the 96 hr LC50 to the 24 hr LC50 helped to substantiate the theory. In addition to indicating a procedure for reducing LC50 values to a common time interval, the study has identified two groups of chemicals. If a chemical is soluble to the extent of 100 micrograms/L or less and possesses a low toxicity, then 96 hrs will not be long enough to accumulate a toxic dose. Examples are the chlorinated biphenyls, where the earliest time to achieve a 50% kill has been shown to be 12 days. Spillage of such a chemical would be no immediate concern from an acute noint of view, as the spill Spillage of such a chemical would be no immediate concern from an acute point of view, as the spill will disperse much faster than the chemical can accumulate in the organism, causing the critical concentration to never be reached. The second group are the more soluble materials, which would have a high probability of accumulating in the organism in a very short period of time. If the agent was sufficiently toxic then a partial kill might result from a spill. Such categorization allows an investigator to make some early decisions on the potential problems resulting from the release of a chemical into an aquatic environment. (Baker-IVI) W85.01966

LONGTERM EFFECTS OF THE HERBICIDES ATRAZINE AND DICHLOBENIL UPON THE PHYTOPLANKTON DENSITY AND PHYSICO-CHEMICAL CONDITIONS IN COMPART-MENTS OF A FRESHWATER POND,

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). J. P. Lay, A. Muller, L. Peichl, W. Klein, and F.

Chemosphere, Vol. 13, No. 7, p 821-832, 1984. 10 Fig. 1 Tab, 22 Ref. Commission of the European Communities contract ENVD-572-D (B).

Descriptors: *Herbicides, *Water pollution effects, *Phytoplankton, Population dynamics, Atrazine, Dichlobenil, Physicochemical properties.

The effects of two herbicides on the phytoplankton community and on physicochemical conditions of the water under outdoor conditions were studied. Attrazine and dichlobenil were dosed in triplicate into the water of a compartmentalized pond. Maximum concentrations of the chemicals detected were 200 micro g/l attrazine and 4.2 mg/l DBN on days 3 to 5 after dosing. Residues were monitored for 55 days, amounting to 60 microg Atrazine and days 3 to 5 after dosing. Residues were monitored for 55 days, amounting to 60 microg Atrazine and 1.5 mg DBN per liter at the end of the study. Oxygen and hydrogen ion concentrations were significantly lower for 35 and 30 days, respectively, in treated as compared to control water. The conductivity of the dosed water was significantly higher for at least 65 (DBN) and 120 days (Atrazine) than in the untreated compartments. Differences in phytopiankton abundance and diversity could be evaluated between controls and treated biotypes. (Baker-IVI) W85-01967

COMPARISON OF THE CARCINOGENIC RISKS FROM FISH VS. GROUNDWATER CONTAMINATION BY ORGANIC COM-POUNDS,

Harvard School of Public Health, Boston, MA. Interdisciplinary Programs in Health.

M. S. Conner.

Environmental Science and Technology, Vol. 18, No. 8, August, 1984. 1 Fig, 1 Tab, 34 Ref. EPA grant CR-807809.

Waste Treatment Processes—Group 5D

Descriptors: *Carcinogens, *Risks, *Fish, *Groundwater pollution, *Organic compounds, Water pollution effects, Public health, Drinking

Water pollution can affect the general public's intake of organic carcinogens through two major pathways: drinking contaminated groundwater and consuming fish from contaminated surface waters. EPA's carcinogenesis risk assessment methodology is used to compare the risks from trace organic contaminants in groundwater to those in freshwater and marine fishes. Carcinogenic risks from consuming freshwater fish are several time greater than for most marine fish. In general, freshwater and estuarine fish from industrialized regions present similar orders of magnitude of risk, about 10 times greater than less-developed estuaries and 50-100 times greater than offshore fisheries. Lipophilic, biologically refractory organics are most often found in fish and soluble, volatile compounds in groundwater. Nationwide, known carcinogenic risks from fish consumption are at least as important as those from groundwater consumption, but both vary widely with location and consumption patterns. The risks reported range between a lifetime risk of cancer of 10 to the 4 to 10 to the -6. (Moore-IVI)

EFFECTS OF ACIDIFICATION ON THE ECOLOGY OF STREAMS IN THE UPPER TYWI CATCHMENT IN WEST WALES, Welsh Water Authority, Powys (Wales).

J. H. Stoner. J. H. Stoner.Environmental Pollution, Vol. 84, p 125-157, 1984.Fig, 6 Tab, 55 Ref.

Descriptors: *Acidification, *Water pollution effects, *Tiwi, *Wales, Sulfates, *Acid rain, Atmosheric deposition, Aluminum, Hardness, Land use, Vegetation, Stream pollution, Trout, Invertebrates.

Water quality data for three rainwater sites and thirteen streams were collected during the period February 1981-January 1983. Although rainfall in the upper Tywi is, on average, amongst the least acidic in the United Kingdom, episodic depositions of acidity do occur. 'Excess' sulfate concentrations in streams were elevated in comparison with those in rainfall, possibly as a result of the collection of 'dry' and 'occult' deposition by vegetation, evaportranspiration and the oxidation of sulfur in drained soils. Stream acidity and aluminium concentrations were, therefore, determined by the combination of stream buffering capacity and vegetation within the catchment. Consequently, the study streams could be classified on the basis of water hardness and land use. Stream surveys and survival studies Water quality data for three rainwater sites and could be classified on the basis of water hardness and land use. Stream surveys and survival studies using caged fish showed that unafforested streams with an average hardness of >8 mg/l can support trout populations and a reasonably diverse invertebrate fauna. Unafforested streams with mean hardness of <8 mg/l can support only sparse fish populations and limited invertebrate diversity. Afforested streams with an average hardness of <10 mg/l are incapable of supporting trout and the invertebrate fauna is very restricted. It is likely that areas with similar soils and geology, receiving similar deposition, can be classified on this basis and water quality data used to predict the fishery and invertebrate status of streams and the likely effects of changed land use. (Author's abstract) W85-02116

LABORATORY ASSESSMENT OF THE TOX-ICITY OF URBAN RUNOFF ON THE FAT-HEAD MINNOW (PIMEPHALES PROMELAS), Massachusetts Univ., Amherst. Dept. of Environ-mental Science. C. Medeiros, R. A. Coler, and E. J. Calabrese.

Journal of Environmental Science and Health, Vol. A19, No. 7, p 847-861, 1984. 2 Fig, 3 Tab, 18 Ref. Dept. of Interior project 126-MASS.

Descriptors: *Urban runoff, *Fathead minnows, *Toxicity, Growth, Hatching, Survival, Water pollution effects, Snowmelt, Seasonal variation.

The early life stage effects of urban runoff (rain and snowmelt) on hatching, growth and survival

of the fathead minnow (Pimephales promelas) was assessed in static and flow-through systems. The data indicate a Maximum Allowable Toxicant Concentration (MATC) and a reduction of growth to 50% of controls at 28% and 60% runoff, respectively. Hatchability and average lengths were not as sensitive indicators of stress as millimeters produced per treatment. The data indicate a maximum toxicity in the fall which coincided with the reported drop in macroinvertebrate diversity during the same period, when untreated runoff events can contribute up to 1/4 of the river flow. (Author's abstract) abstract)

5D. Waste Treatment Processes

COMPUTER CONTROLLED OPERATION OF AN ACTIVATED SLUDGE PLANT, Milwaukee Metropolitan Sewerage District, WI. Treatment Services Div.

J. R. Grinker, and R. F. Meagher.

Journal of the Water Pollution Control Federation,
Vol. 56, No. 7, p 823-829, July, 1984. 11 Fig. 4 Ref.

Descriptors: *Computers, *Automation, *Activated sludge process, Wastewater treatment facilities, Wastewater treatment, Process control, Effluents, Maintenance, Wisconsin.

Maintenance, Wisconsin.

Use of a computer to improve final effluent quality directly and indirectly through better control of the treatment process at the South Shore Wastewater Treatment Plant of the Milwaukee Metropolitan Sewerage District is described. The South Shore Plant is a conventional activated sludge plant consisting of bar screens, grit chambers, primary clarifiers, aeration basins, final clarifiers and chlorination facilities for disinfection. Methane gas from the digestion process is collected and used as fuel for electrical generation, process air blower engines, incineration and boilers, which provide over \$1 million in energy savings per year. The value of automation was demonstrated by benefits in each of the control loops. These general advantages of computer control include reduced operator interface, more stable process control trains, reduced chemical and energy requirements, and improved final effluent quality. To make the entire concept work effectively it is essential to begin with pre-qualified field sensor selection when possible, develop simple control logic based on tested process control techniques and loops with sufficient fail-safe devices for backup, hire or train personnel with strong technical capabilities, establish a sound instrumental maintenance program, and have a commitment to stick with the fine tuning and debugging of each loop when its successful operation predicts sufficient benefits. Each treatment plant should be evaluated individually for the types of control logic and instruments that can best be applied. Once a sound control scheme is established it can continue to work well as long as reliable instruments are used and backed up with a routine schedule of calibration and preventive maintenance. (Baker-IVI) IVI) W85-01652

EFFECT OF LOW DISSOLVED OXYGEN CON-CENTRATION ON EFFLUENT TURBIDITY, Gold Kist, Inc., Atlanta, GA. J. E. Starkey, and P. R. Karr. Water Pollution Control Federation Journal, Vol.

56, No. 7, p 837-843, July, 1984. 5 Fig, 3 Tab, 14 Ref.

Descriptors: *Dissolved oxygen, *Turbidity, *Effluents, *Wastewater treatment, Activated sludge process, Aeration, Atlanta, Georgia, Biochemical

Turbid effluents have been observed at full-scale activated sludge plants operated with low dissolved oxygen (DO) concentrations in their aertion basins. An activated sludge plant in Atlanta, Ga. was operated with average DO concentrations of less than 1 mg/L in the aeration basins as a result of aeration equipment failure. During this period, plant effluent was turbid regardless of

changes in sludge age, aeration basin contacting pattern, amount of solids recycled from sludge handling facilities, and seasonal variations. Once the aeration equipment was repaired and the DO concentration increased to more than 2 or 3 mg/L, plant effluent cleared and effluent suspended solids concentration was reduced. This condition was reproduced in the laboratory with bench-scale reactors fed synthetic wastewater. Increased effluent turbidity at low DO concentrations was the result of inhibition of exocellular polymer production and a reduction in the number of eucaryotic microorganisms. For a food to microorganism (F/M) ratio of 0.3 mg biochemical oxygen demand (BOD ratio of 0.3 mg biochemical oxygen demand usors sub 5)/day/mg mixed liquor volatile suspended sludge (MLVSS), polymer production seemed to be responsible for approximately two-thirds and eucaryote activity for one-third of the changes in effluent turbidly. Substantial increases in filtrate BOD sub 5 concentrations occurred when the DO BOD SUB-15 concentrations occurred when the DO concentration was lowered. This effect was greater at higher organic loading rates. The magnitude of change in suspended solids and BOD sub 5 was such that full-scale plants could be forced out of compliance with discharge permits by operating with mounticient DO concentrations. (Collier-IV1) W85-01653

ULTRAVIOLET DISINFECTION OF SECOND-ARY EFFLUENT,

Trojan Technologies, Inc., London (Ontario).
G. E. Whitby, G. Palmateer, W. G. Cook, J.
Maarschalkerweerd, and D. Huber.
Journal of the Water Pollution Control Federation,
Vol. 56, No. 7, p 844-850, July, 1984. 5 Fig. 9 Tab,
27 Per 27 Ref

Descriptors: *Wastewater treatment, *Disinfection, *Ultraviolet radiation, Bacteria, Chlorination, Economic aspects, Water quality control.

The operational aspects were assessed and efficiency monitored of a full scale UV device designed specifically for disinfecting wastewater. A description of the UV unit indicates that a modular system was designed to require little maintenance and remain versatile. The system consists of a series of modules comprised of four quartz sheath-enclosed UV lamps. Two sets of 10 modules for a total of 8 lamps are located in one effluent channel, Unit 8, the second channel is 40 cm wider and contains 2 sets of 15 modules for a total of 120 lamps, Unit B. The average flows over the lamps of Units A and B are 0.03 cu m/s and 0.02 cu m/s, respectively. Pumps and related maintenance are obviated because it is a gravity flow system. All of the major components are modular to prevent a major shutdown if one component requires maintenance or down if one component requires maintenance or repair. Results show that UV disinfection of treatrepair. Results snow that UV disinfection of freat-ed wastewater is a viable alternative to chlorina-tion if the UV unit is designed specifically for this purpose. UV irradiation of wastewater can reduce the bacterial concentrations to safe levels without introducing a toxicant to fish in the receiving waters. (Baker-IVI)

TWO-STAGE BIOLOGICAL FLUIDIZED BED TREATMENT OF COKE PLANT WASTEWATER FOR NITROGEN CONTROL. Canviro Consultants Lid., Kitchener (Ontario).
S. G. Nutt, H. Melcer, and J. H. Pries.
Journal of the Water Pollution Control Federation,
Vol. 56, No. 7, p 851-857, July, 1984. 4 Fig. 6 Tab,

Descriptors: *Steel industry, *Coke plants, *Industrial wastes, *Wastewater treatment, *Nitrogen, *Fluidized bed process, Fluidized beds, Denitrification, Nitrification, Cyanide, Thiocyanates, Phen-

To assess the technical feasibility of treating coke plant wastewaters in a two stage fluidized bed system operated in the denitrification-nitrification mode, a pilot scale investigation of the process was conducted. The pilot scale system consisted of two fluidized bed reactors in series, coupled to provide carbon oxidation, nitrification, and denitrification in the pre-denitrification operating mode. The flu-

Group 5D—Waste Treatment Processes

idized bed process was capable of achieving complete nitrification and denitrification of undiluted coke plant wastewater without the addition of powdered activated carbon to the system. Total nitrogen removal efficiencies in excess of 90% were maintained in the fluidized bed process at a total system HRT of about 16 hr. The process consistents, attained in excess of 90% and the process of 90% and 15 hr. The process of 90% total system HRT of about 16 hr. The process consistently attained in excess of 90% removal of organic carbon thiocyanate, and phenolic compounds despite step changes in loading conditions and periodic reductions in the efficiency of nitrification. The removal efficiency of total cyanide in the process depended on the fraction of cyanide which was biodegradeable. Operation of the coupled process in the pre-denitrification mode reduced the theoretical oxygen demand of the wastewater by about 66% because of the removal of a substantial fraction of the degradable organic carbon under anoxic conditions in the denitrification reactor. Oxygen requirements for complete carbon under anoxic conditions in the dentiffica-tion reactor. Oxygen requirements for complete nitrification were about 1.0 g oxygen/liter wastewater treated. Flow distribution was a criti-cal factor in achieving high biomass concentrations in the nitrification reactor. (Baker-IVI) W85-01655

RESTORATION OF FAILING ON-SITE WASTEWATER DISPOSAL SYSTEMS USING

WASTEWATER DISPUSAL SYSTEMS USING WATER CONSERVATION, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. W. E. Sharpe, C. A. Cole, and D. D. Fritton. Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 858-866, July, 1984. 5 Fig. 9 Tab, 12 B. dec. 12

Descriptors: *Water conservation, *Wastewater disposal, *On-site disposal, Soil properties, Soil absorption capacity, Water quality control, Public opinion, Clogging, Permeability, Septic tanks.

The wastewater reduction possible with water conservation hardware was documented under conditions of actual use along with changes in wastewater quality and homeowner acceptance of the devices. Maximum level water conservation devices consisting of air assisted toilets, front loading automatic washers, low flow shower heads and faucet flow control aerators successfully reduced the severity of septic tank-soil absorption system malfunctions. Water conservation devices producing lower levels of wasteflow reduction were not successful by themselves in correcting malfunctions, but in three cases where the most inexpensions, but in three cases where the most inexpensions, but in three cases where the most inexpensions. successful by themselves in correcting malfunctions, but in three cases where the most inexpensive water conservation hardware was used in conjunction with an alternate soil absorption system the malfunctions were completely eliminated. Malfunctions of septic tank-soil absorption systems appeared to be closely related to peak waste loadings, precipitation events, and local drainage characteristics. Effluent levels in the malfunction and the processing soil absorption areas fluctuated widely in conservations. ing soil absorption areas fluctuated widely in response to loading, with surface discharge occurring under peak load. Water conservation devices reduced peak effluent loads to all systems. User acceptance of the water conservation devices was very good. Hydraulic load reduction with water very good. Hydraulic load reduction with water conservation devices seems to be a viable method of alleviating failed septic tank soil absorption sys-tems where the cause of failure is slowly perma-ble soil or organic clogging of soils with otherwise acceptable porosity. (Baker-IVI) WB5-01656

PILOT PLANT DEMONSTRATION OF BIO-LOGICAL PHOSPHORUS REMOVAL. MD.

C. W. Deakyne, M. A. Patel, and D. J. Krichten. Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 867-873, July, 1984. 6 Fig, 3 Tab,

Descriptors: *Wastewater treatment, *Phosphorus removal, *Activated sludge process, Industrial wastes, Metals, Phosphates, Biological wastewater treatment. Pilot plants

The A/O process is a modified form of the activated sludge process that promotes the growth of certain microorganisms which absorb large amounts of phosphate while oxidizing the polluting components of the wastewater. The modification consists of the addition of a non-aerated zone upstream of the normal aerated tank. A conventional secondary clarifier with recycle sludge pumps completes the process. The A/O process provides for removal of phosphates from the wastewater via a biological process that incorporates the phosphates within waste activated sludge. The A/O plant produced an effluent with a phosphorus concentration within the NPDES discharge permit limit while simulating the full scale annual average flow of 3.07 cu m/sec with diurnal variations and all four reactor trains in operation. The plant met the effluent BOD5 and suspended solids NPDES permit requirements under both test modes. The sludge from the pilot plant exhibited good flocculating and settling characteristics with average sludge volume index values from 59 to 75 mL/g. The phosphorus is removed from the system via sludge volume index values from 59 to 75 mL/g. The phosphorus is removed from the system via waste sludge with elevated phosphorus levels of about 5% P by weight. The A/O waste activated sludge releases phosphorus if allowed to become anaerobic, and addition of ferric chloride and lime precipitates the released phosphorus in as little as 5 minutes contact time. (Baker-IVI) W85-01657

NONSTEADY-STATE-BIOFILM PROFOR ADVANCED ORGANICS REMOVAL,

Newmark (Nathan M.) Consulting Engineering Services, Urbana, IL. B. E. Rittmann, and C. W. Brunner. Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 874-880, July, 1984. 9 Fig. 3 Tab,

Descriptors: *Wastewater treatment, *Biofilms, *Model studies, Organic compounds, Galactose, Nitrification, Nitrates, Ammonia.

The long term capability of a nonsteady state biofilm to allow efficient removal of a trace level substrate was demonstrated. A mathematical model that predicts the transient growth, decay, and substrate utilization of a nonsteady state bio film was developed and evaluated while the role of nitrification and bacterial adaptation in reducing the rate of heterotrophic biofilm decay under nonnitrification and bacterial adaptation in reducing the rate of heterotrophic biofilm decay under non-steady state conditions was investigated. The non-steady state biofilm process was able to sustain good (> 85%) removal of trace level substrate for I year without reactivation. Although background organic material in the feed medium contributed to reducing the biofilm loss rate, the slow loss of biofilm activity was explained primarily by organic supplementation from nitrification and bacterial adaptation to oligotrophic conditions. The transient biofilm model included growth of loss of biofilm thickness during nonsteady state operation. The model was reasonably successful at predicting biofilm growth and approach to steady state when all input parameters were determined independently. Because of the complications with nitrification, adaptation, and background organics, the model could not be satisfactorily evaluated during the loss phase. The slow decay of the nonsteady state process should be able to achieve advanced organics removal for extended periods of time without requiring sophisticated operating procedures. (Baker-IVI)

MIXING EFFECTS IN UV DISINFECTION, Illinois Univ. at Urbana-Champaign. Dept. of Civil

Engineering.
B. F. Severin, M. T. Suidan, and R. S. Engelbrecht.

Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 881-888, July, 1984. 12 Fig, 10

Descriptors: *Ultraviolet radiation, *Wastewater facilities, *Design criteria, *Disinfection, Wastewater treatment, Kinetics, Mixing, Destratification, Chemical reactions.

The design of UV reactors for the disinfection of wastewater effluents presents a unique set of prob-lems: complex inactivation kinetics, rapid reactions, and complex and nonuniform UV intensity profiles within the reactor. Methods are presented for quantifying mixing effects in single-lamp, annular reactors with nonuniform UV intensity fields through the use of series event inactivation kinetics. An event is assumed to be the total damage incurred in a level of UV exposure. Events occur in a stepwise fashion and each step is considered as an integer function. The rate at which an organism passes from one event level to the next is first order with respect to UV intensity and is independent of the event level occupied by the organism. Batch UV inactivation data were collected in a completely mixed, thin-layer reactor using water nism. Batch UV inactivation data were collected in a completely mixed, thin-layer reactor using water with high UV transmission. Having developed the fundamental concepts of limiting mixing conditions on reactor efficiency for annular single lamp reactors from series event inactivation kinetics, it was determined that mixing in the radial direction is extremely beneficial while mixing in the longitudinal direction is detrimental to reactor efficiency. In general, it is probably beneficial to allow mixing in the longitudinal direction does not occur. These individual concepts of limiting mixing conditions can be combined to qualitatively describe the efficiency of a simple reactor system. (Baker-IVI)

AEROBIC SLUDGE DIGESTION WITH PH CONTROL - PRELIMINARY INVESTIGA-

British Columbia Univ., Vancouver. Dept. of Civil

British Columba Child Engineering. B. C. Anderson, and D. S. Mavinic. Journal of the Water Pollution Control Federation, Vol. 56, No. 7, p 889-897, 7 Fig. 6 Tab, 12 Ref.

Descriptors: *Activated sludge process, *Aerobic digestion, *Hydrogen ion concentration, Wastewater treatment, Industrial wastes, Biological wastewater treatment, Lime.

The behavior of a waste activated sludge undergoing aerobic digestion was examined when the pH of the digesting mass was raised above that found in normal operation. The first phase of the research used clarifier underflow sludge from a pilot scale, wastewater treatment trailer for nutrient removal research. In the second phase the waste sludge came from the clarifier underflow of a convention-al, full-scale, activated sludge plant. At 20 degrees C there was considerable improvement in the efficiency of the digestion process at pHs higher than those usually associated with the field digestion of waste sludge. Depending on the digester pH, the solids retention time and the type of sludge used, VSS destruction efficiencies of almost 54% were obtained. The lime doses needed to attain these performances were considered minimal. Digester vSS destriction entitlentes of almost 34479 were obtained. The lime doses needed to attain these performances were considered minimal. Digester performance was decreased at 12 C and 5 C, mainly because of the biological nature of the process and the temperature responses of the microorganisms. In most cases the conventional sludge outperformed the modified Bardenpho sludge in terms of digestion efficiency in the unbuffered reactors. The modified-Bardenpho sludge responded much better to liming and achieved digestion efficiencies much greater than the conventional sludge at higher pHs. The overall effect of liming at any of the temperatures was to increase the efficiency of the digestion process to the extent that various sets of operating parameters could be chosen to achieve a given VSS reduction. A cost benefit analysis was used to identify possible areas of cost savings from lime pH control. (Baker-IVI) W85-01660

CONVENTIONAL WATER PROCESS COSTS

STUDIED, Texas Univ. at El Paso. Dept. of Civil Engineer-

ing.

A. Tarquin, and S. Goodwin.

Water Engineering and Management, Vol. 131,

No. 7, p 24-27, July, 1984. 2 Fig, 3 Tab, 10 Ref. Descriptors: *Wastewater treatment, *Sludge, *Aeration, *Economic aspects, *El Paso, *Texas, Cost-benefit analysis, Hardness, Turbidity, Water

Waste Treatment Processes—Group 5D

A study is presented of aeration and sludge recirculation processes at an El Paso, Texas water plant. Of 13 parameters measured, only those related to hardness and turbidity were affected by secondary sludge recirculation and aeration. Aeration without sludge recirculation and aeration. Aeration without sludge recirculation did not improve the performance of the primary clarifier with respect to any of the raw water parameters measured. Recirculation of secondary sludge ahead of the primary clarifier effected hardness reduction with significant savings in the cost of lime. Although the largest hardness and turbidity reductions through the clarifier occurred when both sludge recirculation and aeration were practiced, the most cost-effective operating procedure occurred during sludge recirculation only. The commonly applied water treatment practices of sludge recirculation and aeration can significantly affect the removal of some compounds in the primary clarifier. The large increases in energy costs which have occurred over recent years warranted renewed investigations of a case by case basis of the cost effectiveness of such practices. (Baker-IVI) W85-01706

HYDRODYNAMIC OF CIRCULAR PRIMARY

CLARIFIERS, Windsor Univ. (Ontario). Dept. of Civil Engineer-

ing. S.M. Abdel-Gawad, and J. A. McCorquodale. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 299-307, June, 1984. 11 Fig, 30 Ref.

Descriptors: *Clarifiers, *Hydrodynamics, Mathematical equations, Simulation, Velocity, Dispersion, Settling tanks, Water treatment, Wastewater treatment, Prediction, Strip integral method.

The strip integral method has been applied to a typical restricted inlet circular primary clarifier, in order to simulate the flow pattern and dispersion characteristics of the flow. This method assumes a dominant flow direction and with the use of velocity shape functions reduces the equations of motion and continuity to a set of simultaneous ordinary equations. Three shapes were chosen, corresponding to the boundary layer, the potential core, and the free mixing and recirculation zone. A Runge-Kutta method was used to integrate the set of ordinary differential equations. A standard finite element method was used in the withdrawal zone. The numerical predictions compared favorably with experimental velocity distributions obtained in a physical mode of circular sedimentation tanks. The model is restricted to circular clarifiers of in a physical mode of circular sedimentation tanks. The model is restricted to circular clarifiers of discrete suspension with low concentration operat-ing at neutral density environment. The model was used to predict the velocity and dispersion charac-teristics of the circular tanks used at the West Windsor Pollution Control Plant, Windsor, Ontario. (Author's abstract) W85-01716

ADSORPTION OF COPPER, LEAD AND COBALT BY ACTIVATED CARBON, Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.

A. Netzer, and D. E. Hughes. Water Research, Vol. 18, No. 8, p 927-933, 1984. 16 Fig, 1 Tab, 8 Ref.

Descriptors: *Copper, *Lead, *Cobalt, *Activated carbon, *Adsorption, Hydrogen ion concentration, Heavy metals, Metal removal.

The phenomena of lead, copper and cobalt adsorp-tion by activated carbon from aqueous solution was studied in detail. Laboratory studies were conwas studied in detail. Laboratory studies were conducted to evaluate and optimize the various process variables (i.e. carbon type, solution pH, equilibrium time and carbon dose). A quantitative determination of the adsorptive capacity of activated carbon to remove these metals was also determined. Significant differences were found in the ability of different types of activated carbons to adsorb lead, copper and cobalt from aqueous solution. Solution pH was found to be the most important parameter affecting the adsorption. It was found that there was practically no adsorption of lead, copper and cobalt by activated carbon below a well defined solution pH value for each metal.

This critical solution pH value was found to be lower than the pH value associated with the formation of hydrolysis products. Of the ten commercially available activated carbons evaluated in these experiments, Barney Cheney NL 1266 was found to absorb the largest percentage of lead, copper and cobalt. The adsorption of any single metal (lead, copper and cobalt) was hindered by the presence of the other metals; the metals apparently competed for adsorption sites. (Author's abstract) stract) W85-01717

EFFECTS OF BAFFLES ON THE PERFORM-ANCE OF MODEL WASTE STABILIZATION

PONDS, Birmingham Univ. (England). Dept. of Civil Engi-

neering. J. S. Kilani, and J. A. Ogunrombi. Water Research, Vol. 18, No. 8, p 941-944, 1984. 2 Fig, 2 Tab, 11 Ref.

Descriptors: *Stabilization ponds, *Baffles, Wastewater treatment, Hydraulic properties, Bio-chemical oxygen demand, Chemical oxygen demand, Dispersion, Flow pattern.

demand, Dispersion, Flow pattern.

The hydraulic flow pattern in stabilization ponds is one of the major factors influencing pond performance. The performance of three baffled laboratory-scale facultative ponds were compared with that of an unbaffled control pond. The hydraulic characteristics of the ponds were estimated from the results of tracer tests. Biochemical oxygen demand (BOD5) removals achieved with the control pond and with the ponds having 3, 6 and 9 baffles were 79, 81, 86 and 89% respectively and chemical oxygen demand (COD) removals were 81, 84, 84, 2 and 84.2%. The reductions in total solids (TS) were respectively 43, 46, 51 and 64%. The performance of laboratory scale facultative stabilization ponds was found to be considerably improved by decreasing the dispersion index of the pond flow pattern by using baffles. Dispersion indices of 0.161, 0.126, 0.112 and 0.096 were obtained for the control, 3, 6 and 9 baffle ponds respectively, which indicated a trend of decreasing dispersion index with increasing number of baffles. Near-plug-flow conditions were obtained and these are desirable for efficient operation of facultative ponds. (Moore-IVI) (Moore-IVI) W85-01719

INITIAL STUDIES ON THE USE OF HIGH-PERFORMANCE LIQUID CHROMATOGRA-PHY FOR THE RAPID ASSESSMENT OF SEWAGE TREATMENT EFFICIENCY, L. Brown, M. M. Rhead, and J. Braven. Water Research, Vol. 18, No. 8, p 955-961, 1984. 8 Fig, 14 Ref.

Descriptors: *High-performance liquid chromatography, *Wastewater treatment, Chromatography, Activated sludge process, Biological wastewater treatment, Efficiency, Biodegradation.

treatment, Efficiency, Biodegradation.

The difficulties inherent in getting real-time feedback information, suitable for in situ monitoring of biodegradation efficiency, has severely hampered the development of automatic biological treatment optimization and cost effective treatment. High-performance liquid chromatography (HPLC) techniques suitable for the rapid analysis of low-molecular weight polar dissolved organic compounds (PDOC) have been developed and applied to the full-scale field trial assessment of the efficiency of secondary sewage treatment at an activated sludge and percolating biological filter sewage works. The results obtained for the fate of specific polar low-molecular weight constituents are compared with concurrently obtained dissolved and total BOD5, COD, ammonium and total oxidized nitrogen data. HPLC techniques may offer an alternative to BOD5, COD analyses and give an insight into the fundamental removal processes occurring during primary and secondary sewage treatment. (Moore-IVI)

CONTACT FLOCCULATION-FILTRATION OF HUMIC SUBSTANCES,

Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
M. Rebhun, Z. Fuhrer, and A. Adin.
Water Research, Vol. 18, No. 8, p 963-970, 1984.
10 Fig, 4 Tab, 12 Ref.

Descriptors: *Humic substances, *Flocculation, *Filtration, Alum, Polymers, Minerals, Clarification, Wastewater treatment.

Contact coagulation filtration of humic substances gives early breakthroughs shortening the filtration cycles. Contact flocculation filtration of humic dispersions with alum in medium grain (0.62 mm) sand gave short runs to breakthrough, while in coarse (1.2 mm) media clarification was inefficient. coarse (1.2 mm) media clarification was inefficient. Alum with cationic polymer gave in coarse media acceptable runs, but shorter then for mineral dispersions. Analysis of the breakthrough curves and of filtration parameters from different models indicates that initial filtration is rapid and efficient, but the resistance to detachment or disturbance forces is weak. The detachment or disturbance forces overtake with increase in specific deposit values and the low filtration capacity for humic-alumino flocs and corresponding low density of its accumulated deposit indicate a voluminous nature of the deposit. The solid content and the density of alumo-organic deposits in bed are much lower than of alumo-mineral deposits. Polymers and minerals increase the solid content, the density of deposits and the mass capacity of filter beds. (Moore-IVI) W85-01722

MECHANISMS OF METAL ADSORPTION FROM AQUEOUS SOLUTIONS BY WASTE TYRE RUBBER,

Edinburgh Univ. (Scotland). Dept. of Chemistry. A. G. Rowley, F. M. Husband, and A. B. Cunningham. Water Research, Vol. 18, No. 8, p 981-984, 1984. 4

Descriptors: *Adsorption, *Tires, *Cadmium, *Lead, *Mercury, Sulfur, Zinc, Heavy metals, Carbon black, Rubber, Ion exchange, Wastewater

The idea that shredded tire rubber might serve as a suitable adsorbent for the removal of toxic metals from effluents is plausible, particularly considering that vulcanizates contain carbon black (about 30% w/w). Sulfur is also present in the form of thiol groups and polysulfide links which might provide sites for the sorption of metals such as mercury. The mechanisms of adsorption of cadmium(II), mercury(II) and lead(I) on to shredded rubber from old automobile tires were studied. Sorption of mercury (II) and cadmium(II) from aqueous solutions by vulcanized rubber occurs at least partially by an ion-exchange type mechanism involving displacement of zinc(II). There are at least two types of site from which zinc(II) can be displaced. The first type of site is available to cadmium(II) only, whereas the second type can be used by both cadmium(II) and mercury(II) but in a competitive situation mercury(II) is bound in preference. The sorption of lead(II) from aqueous solution by vulcanizates involves an entirely separate mechanism and site of adsorption as compared to mercury(II) and cadmium(III) sorption, and no zinc(II) displacement occurs. (Moore-IVI) W85-01724

KINETICS AND PRODUCTS OF THE CHLOR-INATION OF CAFFEINE IN AQUEOUS SOLU-TION,

Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W85-01727

FATE OF TRACE ORGANICS DURING RAPID INFILTRATION OF PRIMARY WASTEWATER AT FORT DEVENS, MASSACHUSETTS, National Center for Ground Water Res Norman, OK.

S. R. Hutchins, M. B. Tomson, J. T. Wilson, and C. H. Ward.

Group 5D—Waste Treatment Processes

Water Research, Vol. 18, No. 8, p 1025-1036, 1984. 9 Fig. 7 Tab, 38 Ref.

Descriptors: *Land disposal, *Organic compo *Rapid infiltration, *Fort Devens, *Massachu Trace compounds, Groundwater pollt Wastewater treatment, Infiltration.

Transport and fate of trace organics were studied Transport and during rapid infiltration of prumary and during rapid infiltration facility in Fort Devens, Massachusetts. A preliminary sampling trip was made to compare trace organic concentrations in the infiltrating wastewater and in ground water samples from three monitoring wells around the site. Trace organic concentrations were reduced by the rapid However, significant concentrations. from three monitoring wells around the site. Trace organic concentrations were reduced by the rapid infiltration process. However, significant concentrations of specific compounds could be detected in ground water down-gradient of the site. Therefore, a field study was undertaken to determine the primary region where trace organics were removed in the system. Teflon monitoring wells were installed at a depth of 1.2-m in one of the basins at the site prior to flooding. Flooding was initiated and samples of the raw wastewater, the wastewater entering the basin, the infiltrate at 1.2-m depth and the ground water down-gradient of the site were analyzed for six compounds selected for the study. Results from replicate samples during the 6-day flooding period demonstrated that most of the removal for the six compounds occurred in the top meter of the soil, although concentrations of each compound increased substan-

curred in the top meter of the soil, although concentrations of each compound increased substantially in the basin infiltrate from two of the sample points after the fourth day of flooding. No removal of p-dichlorobenzene, p-(1,1,3,3-tetramethylbutyl)phenol and 2-(methylthol)benzothiazole was apparent in the aquifer itself, as indicated by relatively high concentrations of these compounds in the contaminated monitoring well down-gradient of the site. These data indicate that trace organic concentrations in primary effluent can be reduced by rapid infiltration and that most of the removal occurs in the top meter of the soil during the early phase of the flooding cycle. This removal capability can rapidly diminish, however, and result in ground water contamination by trace organics above backgrounds levels. (Author's abstract)

MATERIAL BALANCE ANALYSIS FOR FLUO-RIDE IONS IN EXPERIMENTAL WASTE DIS-POSAL PLANT,
NEC Environmental Engineering Ltd., Tokyo

(Japan).
T. Iwasaki, K. Shirasuka, and S. Hayano.
Water Research, Vol. 18, No. 8, p 1053-1054, 1984.
1 Fig.

Descriptors: *Wastewater treatment, *Fluorides, *Alumina, Adsorbents, Waste disposal.

One problem which arose since the installation of an experimental waste disposal plant at the University of Tokyo has been the increase of the fluoride ion concentration in the discharged effluent over the standard value of 15 mg/liter. Countermeasures were taken by the trial use of activated alumina for adsorbent, and a study on the material balance of fluoride ions was carried out for the whole system. While the concentration of fluoride ions in the effluent can be effectively reduced below the legal level by the calcification-alumina adsorption combined process, there is still a probadsorption combined process, there is still a prob-lem to be solved in treating and removing the residual fluoride ions of 6.2 kg (10%) which is now released into the municipal sewer systems. (Baker-IVD W85-01732

WASTEWATER TREATMENT WITH AER-ATED SUBMERGED BIOLOGICAL FILTERS, Montana State Univ., Bozeman. Inst. for Process Analysis B. Rusten

Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 424-431, May, 1984. 15 Fig, 3

Descriptors: *Wastewater treatment, *Aeration, *Municipal waste, *Filter media, Temperature ef-

fects, Sludge, Biological filters, Biological

Municipal wastewater was treated in two pilot-scale aerated submerged biological filters. Filter media with specific surfaces of 140 sq m/cu m and 230 sq m/cu m were tested. Design should be based on total organic surface load. The treatment efficiency decreased from 75% to 57%, measured as COD removal, when the organic load was increased from 5 g COD/sq m/day to 120 g COD/sq m/day. Volumetric removal rates were in excess of 10 kg COD/cu m in both filters. The organic load influenced the settling ability of the biological sludge. With the filters operating in a two-stage process at overflow rates of up to 0.9 cu m/sq m/hr the effluent suspended solids were below 10 mg/L. Improved settling may occur in full-scale settling basins. With the filters operating as single-stage reactors, specific sludge production roll-scale settling basis. With the filters operating as single-stage reactors, specific sludge production was between 0.35 and 0.55 g TS/g COD removed. With the two stage process the sludge production increased from virtually zero at an organic removal rate of 3 g COD/sq m/day up to 0.40 g TS/g COD removed at a rate of 25 g COD/sq m/day. Oxygen transfer was good in both filters. Aerated submerged biological filters seem to be a good alternative to other biological treatment processes. The microorganisms grow on the media, eliminating sludge recycle and any disturbance resulting from sludge bulking. Trickling filters need a certain minimum hydraulic load to work efficiently. The strong turbulence also ensures good contact between substrate and microorganisms. An aerated submerged biological filter with a high surface area filter media is a simple and compact treatment process. (Baker-IVI) W85-01736

METALS DISTRIBUTIONS IN ACTIVATED SLUDGE SYSTEMS,

Illinois Inst. of Tech., Chicago. Armour Coll. of Engineering.

J. W. Patterson, and P. S. Kodukula.

Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 432-441, May. 1984. 2 Fig, 12

Descriptors: *Metals, *Sludge, *Wastewater analysis, *Model studies, Distribution, Aluminum, Cadmium, Chromium, Copper, Iron, Lead, Nickel,

Models are described which were developed to predict the distribution of metals in activated sludge system process streams. The study focused on eight metals: Al, Cd, Cr(III), Cu, Fe, Pb, Ni, and Zn. Composite samples of the dosed raw sewage, primary effluent, activated sludge mixed liquor, and secondary effluent were collected between 4 and 12 times during each run. The experiments indicated that a number of wastewater and process variables can affect metals distribution between the soluble and solids phases, but these tween the soluble and solids phases. tween the soluble and solids phases, but these findings are not easily extrapolated to continuous findings are not easily extrapolated to continuous-flow systems receiving time-varying inputs of real wastewater. Based on extensive pilot plant data, empirical metals distribution models have been de-veloped which are believed to be generally appli-cable. The models accurately predict the distribu-tion of process stream metals between the soluble and solids phases. There is convincing evidence that solids-bound metals are disproportionately dis-tributed between settleable and non-settleable solids in both raw wastewater and activated sludgesolids in both raw wastewater and activated sludge mixed liquor. One model presented allows for that disproportionate distribution and accurately pre-dicts metals removal across treatment train unit processes. (Baker-IVI)

RAPID BOD MEASUREMENT FOR MUNICIPAL WASTEWATER SAMPLES USING A BIOFILM ELECTRODE,

Washington Univ., Seattle. Coll. of Forest Re-

S. E. Strand, and D. A. Carlson.

Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 464-467, May, 1984. 5 Fig. 9 Ref.

Descriptors: *Biofilms, *Biochemical oxygen demand, Wastewater treatment, Decomposing or-ganic matter, Municipal wastewater.

The response of the biofilm BOD electrode was compared with the conventional 5-day BOD for samples of untreated, primary-settled, and second-ary-treated municipal wastewaters. The biofilm BOD probe provided a signal within 20 minutes that was proportional to the conventional 5-day BOD for soluble organics in primary-settled municipal wastewater and secondary-treated municipal wastewater. The biofilm BOD probe did not respond to the particulate organic matter in untreated municipal wastewater. The precision of the biofilm BOD was comparable to the precision of the conventional 5-day BOD, and the BOD probe could be maintained in a stable condition for up to 3 weeks. (Baker-IVI) W85-01739

IRRIGATION OF PUBLIC USE AREAS BY LAND APPLICATION OF COMBINED INDUSTRIAL AND DOMESTIC WASTE EFFLUENT, Naval Facilities Engineering Command, Charles ton, SC. Southern Div.

W. H. Sloar

Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 474-481, May, 1984. 5 Fig, 4 Tab, 9 Ref.

Descriptors: *Wastewater irrigation, *Irrigation, *Land application, *Waste disposal, *Pensacola, *Florida, Wastewater treatment, Industrial wastes.

The wastewater treatment clinic plant at Naval Air Station Pensacola provides primary and secondary treatment for both the domestic and industrial wastes generated on the Station. Effluent is presently discharged into Pensacola Bay. A project is now under construction for irrigation of two golf courses with the combined effluent. The waste courses with the combined effluent. The waste sources at the station are diverse and unusual, and the wastewater generated is complex and difficult to treat. Therefore, the waste treatment plant has an unusual design using separate modes of pretreatment for domestic and industrial influents and nuerous ponds to dampen surges and provide significant flow retention and system stability. The typically limited water supply potential along the extreme Gulf coastal areas makes water supply a significant problems at the Station. The hydrogeologic character of the area makes the golf courses significant problems at the Station. The hydrogeologic character of the area makes the golf courses favorable sites for land treatment of effluent. The project will provide coincident benefits such as a reduction in potable water use and a decrease in irrigation costs. A better golf course turf will result due to increased availability of water, nitrogen and phosphorous in the effluent. A significant portion of the plant effluent, a potentially useful resource, will be reused when the project is completed. Although the surficial aquifer within the area is readily recharged by surface applied water, this system has been carefully designed in cooperation with state regulatory officials, and poses no threat to water supply sources. (Baker-IVI)

BLUE CRAB PROCESSING PLANT EFFLU-ENT TREATMENT, Maryland Univ., College Park. Dept. of Agricul-tural Engineering. F. W. Wheaton, R. B. Brinsfield, K. M. Lomax, and F. I. Geiger.

and E. L. Geiger. Journal of the Water Pollution Control Federation, Vol. 56, No. 5, p 482-486, May, 1984. 4 Fig, 6 Tab,

Descriptors: *Food processing wastes, *Industrial wastes, *Wastewater treatment, Biochemical oxygen demand, Food processing industry, Coliforms, Biological wastewater treatment, Total suspended solids.

Effluent characterization studies showed that retort effluent had very high BOD5, in the range of 4,000 to 24,000 mg/L. Washdown water and effluent from hand sinks had much lower BOD5 concentrations, in the range of 146 to 710 mg/L. Total and fecal coliform counts were high enough

Waste Treatment Processes—Group 5D

to require disinfecting to meet Maryland discharge guidelines. A 60-mesh screen significantly reduced total dissolved solids of effluent but had little effect on the BOD5, or volatile and nonvolatile solids concentrations in the effluent. An aerated biological treatment system was installed in a blue crab processing plant to treat plant wastewater. Retention time in the treatment system varied with the plant processing schedule, but averaged about 2 days. Water quality results indicate the pilot system will not provide sufficient treatment to meet the BAT (Best Available Technology Economically Achievable) discharge limitations for TSS and BOD5. (Baker-IVI)

ORGANIC AND INORGANIC MERCURY SPE-CIES IN THE FT. LEWIS SOLVENT REFINED COAL PILOT PLANT WATER TREATMENT PROCESS.

Washington State Univ., Pullman. Nuclear Radiation Center.

ation Center.

R. H. Filby, and B. W. Blomquist.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202480, Price codes: A04 in paper copy, A01 in microfiche. Water Research Center Completion Report, December 1983, 52 p, 9 Fig, 16 Tab, 31 Ref. Project No. OWRT A-114-WASH(1), Contract/Grant No. 14-34-0001-2151.

Descriptors: *Wastewater treatment, *Mercury, Coal conversion process, Liquefaction, Pilot plants, Washington, *Activated sludge process, Ef-

The distribution of Hg in the water treatment process of the Ft. Lewis Solvent Refined Coal (SRC II) pilot plant was measured when the plant was operating in a production mode (50 tons coal per day). Mercury was found to concentrate in sulfide-rich process waters as the HgS2(2-) ion. In sunne-rich process waters as the rigs2(2)- ion. in the treatment of organic-rich wastewaters, Hg precipitates on dilution as HgS and is also concentrated in the biosludge and clarifier sludge (Al(OH)3) of the process. A concentration of 2610 ng Hg/g (dry weight basis) was observed in the biosludge. Effluent waters from the treatment process con-(dry weight basis) was observed in the biosludge. Effluent waters from the treatment process contained 0.2 ng Hg/mL, compared to previously determined values of 2 to 5 ng Hg/mL. A 2.8L laboratory unit was constructed to model an operating activated sludge process. A synthetic coal liquefaction wastewater was formulated to contain 619 mg C/L, predominantly in the form of phenols. Mass balance studies of the behavior of HG in this system showed that efficient reduction of HG levels in the feedwater (100 ng Hg/mL) to approximately 4 ng Hg/mL was achieved. Approximately 31 percent of the Hg entering the system was volatilized, presumably as Hgo. The reaction appeared to be reduction of Hg (II) by the bacterial enzyme, mercury reductase since the volatilization was a function of biological activity. The 4 ng/mL levels of Hg in effluent waters was found to be 80 percent organic and 20 percent inorganic in nature. The organic species were not identified but are probably organic complexes of Hg (II) rather than organomercury species (e.g., (H3HgX)). (H3HgX)).

INVESTIGATION OF PHOTOCATALYTIC OXIDATION FOR WASTEWATER CLEANUP AND REUSE,

SumX Corp., Austin, TX. D. W. DeBerry, A. Viehbeck, G. R. Peyton, and

M. Karpinski.

M. Karpinski.

Available from the National Technical Information Sevice, Springfield, VA 22161 as PB84-202548, Price codes: A07 in paper copy, A01 in microfiche. Water Reuse Report RU-83/12, Bureau of Reclamation, Washington, D.C., July 1983. 119 p, 16 Tab, 32 Fig. 82 Ref, 2 Append. Project No. OWRT C-10029-R(1453)(1), Contract/Grant No. 14.34.001.1453

Descriptors: *Water reuse, Water treatment, Solar energy, *Wastewater treatment, Organic compounds, *Photocatalysis, *Oxidation, Titanium dioxide, *Reaction kinetics.

A treatment process was investigated for removal of low concentrations of organic compounds from wastewaters. The treatment process uses light energy as the driving force for the photocatalytic oxidation of dissolved organic species on suspended semiconductor powders. Based on the results of a previous study, TiO2 was the semiconductor used in this program, which was designed to further characterize the process with respect to operating parameters and scope of applicability. Detailed kinetic analyses for the removal of a variety of organic compounds are presented. Factors such as light intensity, amount of semiconductor added, irradiated surface to volume ratio, light intensity, and amount of ionic constituents in the water were also investigated. Actual wastewater samples were obtained from several sources and used for process testing. The degree of effectiveness of the process was found to depend in part on the type of organic molecule being treated. Polar substances and compounds containing nitrogen or sulfur groups were much more susceptible to treatment than unsubstituted aromatics, mineral oils, or saturated hydrocarbons. The relative removal rates were not in direct relationship to the corresponding reaction rates with hydroxyl radicals, indicating that more is involved than hydroxyl radicals, indicating that more is involved than hydroxyl radical production at the semiconductor powder surface. The main limiting rate factor for the systems studied was the low quantum efficiency found, coupled with the wide band gap of TiO2 which allows use of only a small fraction of the solar spectrum.

DISPOSAL OF HOUSEHOLD WASTEWATER IN SOILS OF HIGH STONE CONTENT (1981-

1983), Arkansas Univ., Fayetteville. Water Resources Re-

Arkansas Univ., Fayetteville. Water Resources Research Center.

E. M. Rutledge, C. R. Mote, D. T. Mitchell, M. S. Hirsch, and M. D. Harper.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195809. Price codes: A09 in paper copy, A01 in microfische. Water Resources Research Center Publication No. 103, December 1983. 183 p, 71 Fig, 20 Tab, 32 Ref, 1 Append. Project No. OWRT B-060-ARK(1), Contract/Grant No. 14-34-0001-1204.

Descriptors: Septic tank systems, *Filter fields, Soil adsorption systems, Septic tank treatment, Climatic stress periods, *Wastewater disposal fields, *Wastewater disposal, Wastewater treatment, Soil filtration, Ammonia, Nixa soils, Organic carbon, Nitrates, Nitrification.

Four experimental filter fields were constructed with built-in monitoring equipment in Nixa soils, containing chert fragments, and a fraginan (the design limiting feature) at 60 cm. The four were (1) a 'standard' field, 76 cm deep, above the pan; (2) a 'modified standard', 30 cm deep, above the pan; (2) a 'modified pressure' field, 4 cm deep, above the pan, with pressure distribution, and (4) a 'modified pressure' field, 6 cm below the soil surface. Placing filter fields higher in soil above the pan led to improved hydraulic performance. Approximately a 50% reduction of TOC occurred within all beds, with further reductions of 30% to 40% within 60 cm of the beds. Reductions in NH3 of 10% to 15% occurred within the beds of the 'standard', and 'modified standard' fields, with further reductions of 80% to 90% in the soil. There was a significant reduction in the total of NH3 and NO3 concentrations with distance from the beds. tions with distance from the beds. W85-01815

RUNOFF FROM UTILITY WASTE LANDFILL TO BE RECYCLED FROM DETENTION BASIN TO SCRUBBER MAKE-UP, Johns Hopkins Univ., Laurel, MD. Applied Phys-

J. J. Lentz.

I.J. Lentz. Industrial Water Engineering, Vol. 20, No. 1, p 8-17, January/February, 1983. 3 Fig. 5 Tab, 11 Ref. Maryland Power Plant Sitting Program Contract P1-81-03.

Descriptors: *Runoff, *Settling basins, *Waste disposal, *Vienna, *Maryland, Landfills, Fly ash, Sludge disposal, Powerplants, Heavy metals, Dissolved solids, Calcium, Sulfates.

Runoff from the working face of a proposed landfill for blended fly ash and scrubber sludge at a
Vienna, Maryland powerplant will be captured in a
lined retention basin and used for 7 to 10% of total
scrubber make-up needs in order to prevent escapof heavy metals and high total dissolved solids,
mostly calcium and sulfate ions, into the sensitive
surface water and ground water of the Delmarva
Peninsula. The effectiveness of a runoff detention
basin was investigated using 30 years of daily temperature and precipitation data to simulate continuing operation of the basin and make-up system
under a variety of assumptions and alternate operation rules. The number of potential overflows
which might be calculated is most highly sensitive
to the assumed runoff coefficient. The runoff coefficient will not be a constant, but will vary directly
with the degree to which the surface becomes
saturated during a precipitation event. The system
is sensitive to the rate at which make-up is withdrawn. Although the number of overflows during
3 or 6-week shutdown periods showed increases,
the quantities of runoff spilled remained small.
While the number of spills varied greatly as a
function of both runoff coefficient and withdrawal
rate, with careful matching of facilities design and
operation to expected demand, a basin designed to
hold contaminated runoff for recycling represents
a workable approach to the management of an
otherwise serious waste disposal problem. (BakerIVI) W85-01849

STATE-OF-THE-ART OF THE ELECTRODIA-LYSIS REVERSAL (EDR) PROCESS.

Industrial Water Engineering, Vol. 21, No. 1, p 12-20, Winter, 1984. 4 Fig. 3 Tab, 8 Ref.

Descriptors: *Electrodialysis, *Wastewater treatment, Membrane processes, Water treatment, Minerals, Water quality control.

The Electrodialysis Reversal Process (EDR) removes ionized salts and minerals from water and concentrates them in smaller volumes of water by concentrates them in smaller volumes of water by means of direct current electricity. The DC electricity moves ions from a demineralizing or diluting compartment through selective ion exchange membranes into an adjoining concentrating compartment. This process is more tolerant than other commercially available membrane processes of a wide range of troublesome organic, inorganic, colloidal, and biological contaminants in water. The predominant use of EDT for much of the 1970s was the demineralization of brackish waters of several thousand parts per million total dissolved solids to potable levels of a few hundred parts per million for municipalities, oil and construction camps, hospitals, hotels, military bases, bottlers of beverages and purveyors of bottled water. By mid-1983, five public utility steam-electric generating stations with an aggregate capacity of 4000 MW had chosen EDR to pretreat boiler feed water prior to ion exchange demineralization. The basic principles for electrodialysis and EDR are defined principles for electrodialysis and EDR are defined and other applications of the method are given. (Baker-IVI) W85-01851

REDUCTION OF COSTS AND LIABILITY RISKS IN ELECTROPLATING WASTEWATER TREATMENT, A. C. Salas, and H. J. Cunha.

Industrial Water Engineering, Vol. 21, No. 2, p 9-13, Spring, 1984. 4 Fig. 5 Tab, 8 Ref.

Descriptors: *Wastewater treatment, *Electroplat-ing, *Industrial wastes, Economic aspects, Electro-dialysis, Reverse osmosis, Evaporation, Ion ex-change, Waste recovery.

The Federal Water Pollution Control Act prohib-The Federal Water Pollution Control Act promo-its the discharge of pollutants into waterways from any point source, unless an appropriate permit has been issued. A summary of the Federal technolo-gy-based standards and their applicability is offered for the treatment of wastewaters from the electro-plating industry. End of the line systems are used to clean the effluent streams just before discharg-

Group 5D—Waste Treatment Processes

g. These include steps to ensure the destruction f cyanides by oxidation with chlorine gas, sodium hypochlorite, hydrogen peroxide, or ozone; reduc-tion of chromates by chemical or electrochemical nypocationie, avviogen percouste, or ozine, reduc-tion of chromates by chemical or electrochemical means; combination of all metal bearing streams, adjustment of pH, and precipitation of metal hy-droxides or sulfides; settling of suspended solids in a clarifier; thickening of the clarifier's overflow, and discharge. Recovery systems are considered in-cluding evaporative concentration, reverse osmo-ais, electrodialysis, ion exchange, and electrolytic techniques. To establish a comparison between the various systems discussed with respect to cost and performance, a nickel plating operation was used an as example and costs and performance were estimated for each technology. While recovery systems are not the answer to all the water prob-lems in electroplating operations, they should be the first ones to be considered in new installations and even as potential replacements for existing destructive systems. (Baker-IVI)

ANALYSIS OF QUANTITATIVE WASTEWATER MEASUREMENTS OF A COUNTRY RESTAURANT SITUATED AT APPROXIMATELY 1000 M ALTITUDE AND OF A MOUNTAIN INN SITUATED AT APPROXIMATELY 1410 M ALTITUDE (AUSWERTUNG VON SCHMUTZWASSER-MENGENNIESSUNGEN BEI EINEM AUSFLUGSRESTAURANT, RUND 1000 M U, M. UND BEI EINEM BERGGASTHOF, RUND 1410 M U, M.), Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland). H. Weber.

Wasser, Energie, Luft, Vol. 75, No. 3, p 37-42, 1983.

Descriptors: *Wastewater, *Restaurants, *Hotels, Wastewater treatment, Domestic wastes, Recrea-

The country restaurant (excursion restaurant) is on a throughfare and is the departure point for hiking and sking trips. The restaurant seats 100, with 200 seats on the sun-terrace. The scenic mountain inn is for tourists and guests. Outside the 120 seat restaurant is room for 70 places, and the guesthouse has for tourists and guests. Outside the 120 seat restaurant is room for 70 places, and the guesthouse has 30 beds. The wastewater of the two restaurants was measured quantitatively. The most important results obtained from the quantitative wastewater measurements are described and compared with previous data. With regard to the relative wastewater peaks, expressed in multiple daily means, the absolute peak values for 20, 60 and 120 minutes are plotted in liters per second. These wastewater handling levels determine treatment system parameters. (Moore-IVI) W85-01854

YIELD AND QUALITY OF COTTON GROWN WITH WASTEWATER, Arizona Univ., Tucson. Dept. of Plant Sciences. A. D. Day, and J. A. McFadyen.
BioCycle, Vol. 25, No. 3, p 35-37, April, 1984. 3 Tab, 10 Ref.

Descriptors: *Water reuse, *Irrigation, *Crop yield, *Arizona, Water conservation, Cotton, Nutrients, Nitrogen, Salts, Phosphorus.

The effectiveness of municipal wastewater as a source of irrigation water and plant nutrients has been demonstrated in cotton production in Arizona. The crop was planted in April and harvested in November in each year. About 122 cm (48 inches) of irrigation water were required to produce a cotton crop. Two sources of irrigation water included pump water from local wells, and municipal wastewater and pump water in a 50:50 mixture. The pump water contained 4,600 ppm total soluble salts, 21 ppm nitrate nitrogen, 22 ppm total nitrogen, and 0 ppm elemental phosphorus. The wastewater and pump water mixture contained 3,400 ppm total sitosopen, 3,400 ppm total nitrogen, and 4 ppm elemental phosphorus. Fifty-six kg/ha of nitrogen fertilizer were applied prior to planting the cotton that was

irrigated with pump water, increasing the total nitrogen to 334 kg/ha. Cotton grown with the mixture was taller, produced more seed cotton and lint cotton than cotton irrigated with only pump water. The wastewater when added to the pump water had no significant detrimental effects on most cotton fiber quality characteristics. (Baker-W85-01869

CONSTRUCTION OF RATIONALIZATION EQUIPMENT AT THE ROSTOCK WATER-SUPPLY AND WASTEWATER-TREATMENT FACILITY (RATIONALISIERUNGSMITTEL-BAU IM VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG ROSTOCK),

VEB Wasserversorgung und Abwasse lung, Rostock (German, D.R.). For primary bibliographic entry see Field 5F. W85-01877

ENERGY STUDIES OF WASTEWATER-TREATMENT FACILITIES AS A BASIS FOR OPTIMAL ENERGY USE (ENERGIESTUDIEN VON ABWASSERBEHANDLINGSANLAGEN ALS GRUNDLAGE FUR DEN OPTIMALEN ENERGIEEINSATZ),

Wasserwirtschaft, Erfurt VEB Projektierung (German, D.R.).

H. Lopp. Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 21-23, January, 1984. 1 Fig, 3 Tab, 5 Ref.

Descriptors: *Wastewater treatment facilities, *Energy, Gas production, Sludge treatment, Heat, Economic aspects, Pumps, Aerators.

The choice of means of energy supply for a wastewater-treatment facility (WTF) and of utilization of gas produced by the WTF demands in consideration of specific WTF conditions and the consideration of specific WTF conditions and the regional energy-supply structure. Criteria include economical effectiveness, longevity of machinery, feasibility of installation, and fullest possible energy supply of the WTF by self-produced gas and wastewater heat. Comparative energy-supply/gas-utilization studies should be preceded by efforts to optimize wastewater- and sludge-treatment processes and to reduce electrical and thermal energy requirements. Measures to reduce electricity demand include improvement of aeration equipment and correct adaptation of pumps to output. Heat requirements can be reduced by well constructed and insulated buildings and, in the case of sludge digestion plants, a better volume: surface ratio. Maximal gas production can be achieved through optimal design of the digestion tank with suitable scaling and insulation materials as well as intensification of the digestion process, including through optimal design of the digestion tank with suitable scaling and insulation materials as well as intensification of the digestion process, including thickening of raw sludge, adequate circulation of digestion-tank contents, and maintenance of optimal tank temperature. The basis for effective gas utilization is its transformation into a usable form of energy, ensuring high energy level during transformation; coupling gas utilization with other energy-producing equipment, e.g., heat pumps with a high level of primary energy exploitation, and installation of the most economical energy carrier. Models for utilizing gas and supplying energy include gas boiler + coal boiler (to cover peak demand) + transformation of excess gas into fuel; gas boiler + coal boiler + selling excess gas; block thermal power station (BTPS) + gas boiler + coal boiler; BTPS + compression heat pump. (Gish-TVI) W85-01878 W85-01878

DEVELOPMENT OF THE SCHWARZHEIDE CHEMICAL SYNTHESIS WORKS IN THE FIELD OF WASTEWATER AND BY-PRODUCT TREATMENT (ENTWICKLING DES VEB SYNTHESEWERK SCHWARZHEIDE AUF DEM (EPRIET DEP BWASSER), IND ADDRO SYNTHESEWERK SCHWARZHEIDE AUF DEM GEBIET DER ABWASSER- UND ABPRO-

DUKTBEHANDLUNG), VEB Synthesewerke, Schwarzheide (German, D.R.)

R. Heepe. Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 42-43, February, 1984. 1 Fig. Descriptors: *Chemical undustry, *Industrial wastewater, *Herbicides, Chemical wastes, Activated sludge treatment, Biological wastewater treatment, Costs, Cooling water, Recycling, Water

The Schwarzheide chemical works manufactures herbicides and polyurethanes (polyester-and polyester alcohols plus isocyanate) in the German Democratic Republic. It produces highly polluted wastewater as well as toxic solid and liquid by-Democratic Republic. It produces highly polluted wastewater as well as toxic solid and liquid byproducts. At the works, by-products are incinerated. All wastewater is treated on-site by a two-stage activated sludge facility and nitrification, while wastewater with COD up to 30,000-100,000 mg/l goes through two preliminary steps (thermal purification, biological treatment) and that with COD 1,500-30,000 mg/l goes through the biological preliminary step. Elimination of 90-89% of COD, 5-day BOD, phenols, nitrate, ammonia, herbicides, and anline is achieved, but the annual cost of 45 million Marks has necessitated efforts to improve economic efficiency. Industrial and cooling water demand has dropped by about 30%, thereby reducing the wastewater volume and saving 1,000 manhours/yr and 305,000 Marks/yr. Continuous measurement of ammonia and phosphate in wastewater has resulted in lower dosages of nitrogen and phosphorus for a 900,000 Marks/yr saving. Sludge resulting from wastewater treatment is no longer incinerated but used in the reclamation of mine dumps, saving over 3 million Marks worth of fuel oil. By-prioducts of isocyanate manufacture are recycled, saving 11 million Marks/yr. Gas resulting from the production process has been substituted for fuel oil used in the incinerator, resulting in an annual reduction in oil consumption of more than 5,000 tonnes. (Gish-IVI) W85-01881

IMPROVED OPERATIONAL CONTROL OF IMPROVED OF PERATIONAL CONTROL OF SEDIMENTATION FACILITIES THROUGH THE USE OF FIBEROPTIC SENSORS (VERBESSERTE BETRIEBSKONTROLLE VON SEDIMENTATIONSANLAGEN DURCH NUT-ZUNG FASEROPTISCHER SENSOREN),

VEB Zellstoff- und Papierfabrik, Rosenthal (German D.R.).

A. Geisenheiner, M. Wyrwich, and A. Hoffmann Wasserwirtschaft-Wassertechnik, Vol. 34, No. 2, p 43-45, February, 1984. 4 Fig. 8 Ref.

Descriptors: *Fiberoptics, *Sensors, *Particulates, *Sedimentation, Wastewater treatment, Industrial wastewater, Pulp wastes, Suspended solids.

A device was developed at the Rosenthal pulp and paper factory, Blankenstein, German Democratic Republic, to monitor the recirculator in its sedimentation facility, which is used in the treatment of industrial water. The device was needed to control suspended and settled particulates, which due to various factors in the sedimentation process often exceed the number permitted by law in wastewater treatment. A submersible probe was developed using photoconductive fibers; this can be called up to provide an underwater profile of particulate distribution. The probe consists of two sensor arms, one bearing a lamp and one bearing a phototransistor. In the measurement aperture between the two sensor arms, which is lit by the lamp, the flocs cause absorption impulses that are opto-electronically transformed by the phototransistor, then amplified and plotted. Fiberglass cables beam the light from the lamp to the measurement aperture and transmit the absorption impulse from the floc to the phototransistor. The light-beam diameter is determined by the most common floc size, while the absorption aperture is fixed according to maximum sensitivity of the phototransistor. diameter is determined by the most common note size, while the absorption aperture is fixed accord-ing to maximum sensitivity of the phototransistor at a given light intensity. The probe was used for several months without problems to prove its reli-ability and usefulness. It could also be used in activation basins and in natural waters up to 100 m deep. (Gish-IVI) W85-01882

FRIEDRICHRODA WASTEWATER TREAT-MENT FACILITY - RESULTS OF AN EXPERI-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Waste Treatment Processes—Group 5D

MENT (KLARANLAGE FRIEDRICHRODA -ERGEBNISSE EINES EXPERIMENTS), VEB Wasserversorgung und Abwasserbehandling, Erfurt (German, D.R.). F.-W. Moller, H. Kuhles, and J. Hattenbach. Wasserwitschaft-Wassertechnik, Vol. 34, No. 3, p 58-64, April 1984. 11 Fig, 4 Ref.

Descriptors: *Wastewater treatment facilities, *Construction, *Friedrichroda, *East Germany, Costs, Centrifugal pumps, Pipes, Aeration, Sludge stabilization, Tanks, Optimization.

The new wastewater treatment plant (15,500 population equivalents, 160 cu m/hr dry-weather wastewater inflow) at the German Democratic Republic spa resort of Friedrichroda was constructed on the site of an old one, which continued to operate during the building process. The rake house with its vertical bar rake was built without a dumn container of bridge crane (debris was dishouse with its vertical bar rake was built without a dump container or bridge crane (debris was discharged directly into a trailer and hauled away). Wastewater is driven into the two activation basins by means of two above-ground centrifugal sewage pumps, each with a series-connected intake container. Activation, tertiary-treatment, thickening, and sludge-stabilization tanks were built above ground to reduce costs by eliminating underground construction; the choice of wood as a construction material was not ideal. Constructing service bridges from steel was successful; design and corrosion prevention are especially important. service bridges from steel was successful; design and corrosion prevention are especially important. The use of insulated open-air pipes with auxiliary electrical heaters was advantageous due to elimination of underground construction and good conditions for installation. Aeration of the two activation basins is achieved by an injector system. Optimization of the sludge stabilization process was achieved by experimentation. Costs were considerably reduced by the construction and treatment methods. (Gish-IVI) W85-01884

WASTEWATER PURIFICATION AS RELATED TO THE STUDY OF A RIVER SYSTEM (AB-WASSERREININGUNG IN VERBINDUNG MIT DER UNTERSUCHUNG EINES FLUSSSYS-TEMS), Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-

dapest (Hungary).
P. Paszto, and A. Horkai.
Wasserwirtschaft-Wassertecht

nik, Vol. 34, No. 3, p 67-69, April, 1984. 3 Fig, 4 Ref.

Descriptors: *Water pollution control, *Wastewater treatment, *Rivers, Water quality, Costs, Regulations, Standards, Planning, Comput-

Using the example of a river system (consisting of main river, tributary, and periodic stream emptying into the main river), it is demonstrated that water pollution and the demand for good-quality water can be treated as a spatial unit. This concept results in the elimination of unnecessary water facilities when compared with the traditional method of viewing users as individual units. In the planning stage, the complicated nature of the river system concept with the necessity of providing for compliance with standards and regulations throughout the entire system rather than for individual facilities requires computer technology. Examples of calculations for guaranteeing water-quality requirements and for various costs are given. (Gish-IVI)

COMPUTERIZED DISTRIBUTION RECORDS-

CADD PAVES THE WAY, Donohue and Associates, Inc., Waukesha, WI. For primary bibliographic entry see Field 5F. W85-01902

REDUCTION OF THE USE OF MATERIALS REDUCTION OF THE USE OF MATERIALS WITH THE AID OF SCIENCE AND TECHNOLOGY AT THE HYDROTECHNOLOGY AND WATER-MANAGEMENT-PLANNING COMBINE (SENKUNG DES PRODUKTIONSVERBRAUCHS MIT HILFE VON WISSENSCHAFT UND TECHNIK IM VEB KOMBINAT WAS-

SERTECHNIK UN PROJEKTIERUNG WAS-SERWIRTSCHAFT), VEB Projektierung (German D.R.). K. Heilmann. Wasserwirtschaft, Halle

Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 45-46, February, 1983. 1 Ref.

Descriptors: *Wastewater treatment facilities, *East Germany, *Costs, Construction, Biological wastewater treatment, Pipes, Rakes, Blowers.

The German Democratic Republic Hydrotechnology and Water-Management Planning Combine (HTWMP) produces industry-specific equipment and rationalization devices to aid in the intensifica-(HTWMP) produces industry-specific equipment and rationalization devices to aid in the intensification of the water industry in compliance with government policy. One of the goals of rationalization is to reduce the amount of materials used in production while increasing production. An example of reduction in materials usage is a compact small-scale sludge-activation facility produced at the Merseburg wastewater treatment facilities to provide complete biological treatment of municipal wastewater. The compact facility corresponded to international standards with regard to performance, but the amount of material used in manufacture was too high. Cooperative study between workers, technology experts, and designers resulted in a 21% reduction in materials, especially in steel plate and pipe. Increased efficiency was achieved by means of a new type of blower, and this also reduced construction costs for the blower house by 30%. The central HTWMP has begun work to improve rake design; already 22% of material has been saved by redesigning the fork rake, and manufacture has been simplified. The next step will be the standardization of rakes, so that they will all be constructed according to the same principle. Reduction in materials usage can also be achieved by preventive maintenance to avoid repairs. (Gish-IVI)

INTENSIFICATION OF WASTEWATER AND SLUDGE TREATMENT PROCESSES THROUGH UTILIZATION OF THE ENERGY POTENTIAL OF WASTEWATER (INTENSIVIERUNG DER ABWASSER-UND SCHLAMMBEHANDLINGSPROZESSE DURCH NUTZUNG DES EIGENENERGIEPOTENITALS DER ABWASSER), VEB Projektierung Wasserwirtschaft, Halle

DER ABWASSER),
VEB Projektierung Wasserwirtschaft, Halle (German D.R.).
G. Voigtlander, and R. Zemlin.
Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 54-47, February, 1983. 2 Tab, 24 Ref.

Descriptors: *Wastewater treatment, *Energy recovery, Biological wastewater treatment, Sludge treatment, Biogas, Heat, Construction costs, Chemical treatment.

The energy crisis demands utilization of the energy potential of wastewater. This potential consists of wastewater heat and energy-rich organic matter. Heat in wastewater can arise from the industrial process producing the wastewater or from municipal wastewater, which can be 5 K warmer than drinking water. Biological gas from wastewater and sludge treatment has been transformed into mechanical or electrical energy with simultaneous utilization of waste heat at wastewater treatment facilities. A relatively new development has been the installation of heat pumps driven by biological gas, which use thermal energy from wastewater. Past efforts to optimize wastewater treatment have concentrated on biological processes occurring under natural environmental conditions. Future efforts should emphasize chemical treatment proce-The energy crisis demands utilization of the energy under natural environmental conditions. Future ef-forts should emphasize chemical treatment proce-dure with the specific goal of reducing construc-tion costs. Intensification of the chemical proce-dure leads to reduced reactor volumes and thereby to a need for less equipment and lower construc-tion costs. Raising temperatures to increase treat-ment speed is significant, especially in the case of highly concentrated wastewater and sludge. An-archite processes will become increasingly impormgmy concentrated wastewater and studge. An-aerobic processes will become increasingly impor-tant due to their low energy consumption, as will the breeding of microorganisms for biological treatment at high temperatures. Tables are given for temperature-dependent wastewater and sludge

chemical treatment methods for temperatures < or = to 353 K and = or > 353 K. (Gish-IVI) W85-01970

SUGGESTION FOR YEAR-ROUND WASTEWATER UTILIZATION IN THE FORESTRY INDUSTRY (VORSCHLAG ZUR GANZJAHRIGEN ABWASSERVERWERTUNG IN DER FORSTWIRTSCHAFT),

M. Bahler, E. Drus, and R. Lutzke. Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 60-62, February, 1983. 1 Fig, 1 Tab, 3 Ref.

Descriptors: *Frankfurt (Oder), *East Germany, *Land disposal, *Forestry, Wastewater disposal, Wastewater irrigation, Crop yield.

In order to eliminate the need to construct expensive tertiary wastewater treatment plants in the Frankfurt (Oder) region of the German Democratic Republic, preliminary studies were made for a pilot facility for the application of wastewater to forested land. This practice confers the same benefits as agricultural wastewater application (increased crop yield and wastewater purification through nutrient uptake by plants and filtering ability of soil) but unlike agricultural application can be continued throughout the entire year. The site chosen should be far from groundwater supplies with a permeable soil and should preferably be completely flat. Wastewater is applied via shallow furrows up to 200-m long, between which the trees are planted in rows. High wood yields are achieved with poplars and willows (25 cu m/hectare); this represents a three to four times higher yield than that produced from pine trees on the same, non-treated soil. Year-round application (75 mm every 2 wk; 1,800 mm total) resulted in the removal of 71.4% of total nitrogen (as measured in percolating water) and almost complete elimination of 5-day BOD and phosphates. Problems relating to health are significantly fewer with forest than with agricultural application, since forestry products are not used for human consumption. The preliminary studies resulted in the selection of two suitable forest areas for the pilot facility. (Gish-IVI) In order to eliminate the need to construct exp

W85-01971

ENZYMATIC HYDROLYSIS TESTS ON AN IN-DUSTRIAL EFFLUENT PRIOR TO ITS BIO-LOGICAL PURIFICATION (ESSAIS D'HYDRO-LYSE ENZYMATIQUE D'UN EFFLUENT IN-DUSTRIEL AVANT SON EPURATION BIOLO-GIOUE). R. Mesnier

Aqua, No. 6, p 471-476, 1982. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Industrial wastes, *Bulking sludge, *Wastewater treatment, *Enzymes, *Hydrolysis, Sludge, Bacteria, Biological treatment.

Studies were undertaken to determine the effect of retrograded boiled starch present in effluent to be treated on the bulking of sludge. When treating industrial effluent by biological means after enzy-matic hydrolysis of the starch, the following points surfaced: enzymatic hydrolysis of the starch by amylase allowed the retrogradation of the boiled amylose to be avoided; this allowed the assimila-tion of the amylose and of the amylopectin by the tion of the amylose and of the amylopectin by the purifying flora through the almost complete transformation of these compounds into simple sugars. This also limited the bulking phenomenon and rebalancing of the micro-fauna in the activated sludge. The development of filamentous bacteria was accompanied by an increase in the concentration of insoluble sugars (retrograded boiled starch) in the activated sludge. Application of this enzymatic hydrolysis technique was insufficient to bring about complete regression of bulking sludge in full expansion. Filamentous bulking of activated sludge depends both on a limiting substrate that is hard to assimilate and on the qualitative balance between the various nutrients necessary to the hard to assimilate and on the qualitative balance between the various nutrients necessary to the microorganisms to ensure the degradation of car-bonaceous matter and purification of the wastewater. The pretratment of substrates by en-zymatic hydrolysis is not a sure-fire weapon in

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

dealing with bulking phenomena in general. (Baker-IVI) W85-01975

STUDY CASES OF OPERATIVE CONDITIONS OF MUNICIPAL TREATMENT BY LAGOONING (ETUDE DES CONDITIONS DE FONCTIONNEMENT ET D'EXPLOITATION DE QUELQUES CAS CONCRETS DE TRAITEMENT D'EAUX RESIDUAIRES URBAINES PAR LAGUNAGE, Societe L'oupnaise des Eure et de l'Edelman Desire

aise des Eaux et de l'Eclairage, Paris Societe Lyon

N. Dalga, G. M. Faup, and M. Ferry. Aqua, No. 6, p 477-480, 1982. 7 Fig.

Descriptors: *Lagoons, *Municipal wastewater *Aerated lagoons, Wastewater treatment, Biologi-cal oxygen demand, Chemical oxygen demand. Operating costs, Bacteria, Sludge lagoons.

In a study of 22 aerated lagoons and 9 natural lagoons in France, aerated lagoons were found to be under-sized compared to the generally accepted values; this is not usually the case with natural lagoons. Problems connected with the creation of lagoons were the seal of the reservoirs, dike stabililagoons were the seal of the reservoirs, dike stability, communications between reservoirs, and aerating devices. The main parameters taken into account for the purifying performance of lagoons were usual rejection parameters (MES-COD-BOD5) as well as the bacteriological charge. The results obtained were, generally, 90% on BOD5 and 75% on MES due to the presence of algae in the treated effluents. There was a reduction in the the treated effluents. There was a reduction in the germ tests of 10 to the power of 4 or 6. The various maintenance operations were estimated in order to establish an operating cost. A first study of the energy consumption of aerated lagoons was carried out to establish a comparison with the usual methods. The major heavy operation in the running of lagoons concerns the extraction of sludge. The study made it possible to establish an average cleaning frequency while also finding a means of controlling silting. (Author's abstract) W85.01976. means of

BIOLOGICAL FOULING OF REVERSE OSMO-SIS MEMBRANES,
Orange County Water District, Fountain Valley,

CA.
D. G. Argo, and H. F. Ridgway.
Aqua, No. 6, p 477-480, 1982. 22 Fig, 8 Tab, 6 Ref.

Descriptors: *Membrane processes, *Reverse osmosis, *Wastewater treatment, Wastewater renovation, Detergents, Membranes, Enzymes, Chlorotte

During 28 months of operation, the Water Factory 21 experienced an overall flux decline rate of 21 experienced an overall risk decime rate of -0.159 gfd/month due to fouling in its wastewater demineralization plant, and a 40% decline in flow. The fouling layer was 90% organic and contained considerable quantities of carbohydrate, protein and adenosine triphosphate. A total bacterial count of about 7,500,000 cells/ml and a viable bacterial count of 10,000 cells/ml in the feedwater was noted. The fouling layer consisted primarily of bacteria attached to surfaces of the cellulose acebacteria attached to surfaces of the cellulose ace-tate membranes. The increase in bacterial numbers associated with the reverse osmosis membranes was inversely related to a progressive decline in membrane water flux. When the membranes were exposed to a free chlorine residual of 10 to 15 mg/l for a few days, they were rapidly destroyed. Eval-nation of a number of different cleaning solutions indicated several were capable of removing the biofilm in laboratory experiments. The membranes receiving chlorinated feedwater appeared to clean better than those receiving nonchlorinated feed. All cleaners were less effective over time as the amount of biofilm on the membranes surfaces inamount of biofilm on the membrane surfaces in-creased. The most effective solutions were combi-nations of detergents and enzymes. (Baker-IVI) W85-01977

USE OF ARTIFICAL WETLANDS TO REMOVE NITROGEN COMPOUNDS FROM NITROGEN WASTEWATER

Ecological Research Associates, Davis, CA. R. M. Gersberg, C. R. Goldman, and B. V. Elkins. Aqua, No. 6, 492-496, 1982. 4 Tab, 4 Ref.

Descriptors: *Wastewater treatment, *Nitrogen, *Nitrate, *Artificial wetlands, Wetlands, Bacteria, Biological treatment, Biological wastewater treat-

The deleterious effects of nitrogen on both surface and groundwater supplies have led to a significant increase in research focused on the development of increase in research focused on the development of cost-effective and energy-efficient nitrogen removal process. Our investigations at Santee, California, have demonstrated the exceptional utility of artifical wetlands (800 sq m) for the removal of nitrate from nitrified secondary wastewaters at relatively high application rates. The major loss of nitrogen from these wetland systems was due to bacterial denitrification. When no carbon source was added to the march badt to supplement the carbon supple from these wetland systems was due to bacterial from these wetland systems was due to bacterial denitrification. When no carbon source was added to the marsh beds to supplement the carbon supply and fuel the denitrifical wetlands was relatively low (8%). However, when the artifical marsh beds were amended with methanol, mean removal of TN (total nitrogen) was 94% at an application rate of 20 cm per day. Since artifical wetlands provide an ideal environment for photosynthetic carbon fixation as well as denitrification, we tested the efficacy of using plant biomass, nulched and applied to the surface of the artifical marsh beds, as an alternate and low-cost source of carbon. In mulch-amended beds the mean removal efficiencies were 70% for the TN and 77% for TIN (total inorganic nitrogen) at an application rate of 20 cm per day. Rising operational and energy costs make biological systems such as artificial wetlands very attractive as low-cost, low-energy systems for removal of nitrogen from municipal and agricultural wastewaters and contaminated groundwater supplies. (Author's abstract)

Katadyn Products, Inc., Wallisellen (Switzerland). M. Angelrin. Aqua, No. 2, p 109-115, 1984. 17 Fig. 5 Tab, 18 Ref. ULTRAVIOLET DISINFECTION OF WATER.

Descriptors: *Ultraviolet radiation, *Water treatment, *Disinfection, Drinking water, Potable water, Water quality control, Bacteria, Microorga-

The first prototype unit for ultraviolet disinfection of water was built in 1910 in Marseille. The method was introduced into treatment of public water supplies in Switzerland in the 1950s. In Europe over 2000 communities now disinfect their drinking water with ultraviolet rays. Sufficient exdrinking water with ultraviolet rays. Sufficient ex-posure and intensity inactivate irreversibly the DNA of microorganisms. Water quality and ageing of UV lamps in operation also have to be considered when dimensioning UV plants. Scientifi-ic tests using specific microorganisms and naturally contaminated water conclusively prove the safety of this method of disinfection. It is a cost-effective and valid alternative to oblogination and does not and valid alternative to chlorination and does not require the addition of chemicals to the water. (Baker-IVI)

CHLORINATION OF COOLING WATERS AND QUALITY OF WATER RESOURCES,

Antwerpse Waterwerken (Belgium). W. Van Craenenbroeck. Aqua, No. 3, p 165-169, 1984. 1 Fig, 23 Ref.

Descriptors: *Drinking water, *Chlorination, *Cooling towers, *Water quality control, Potable water, Microorganisms, Heat treatment, Powerplants, Industrial wastes.

Cooling waters from electric power plants are chlorinated in order to prevent bacterial slime for-mation in the condensor pipes, or mussel growth in the intake culverts. What effects this causes in the environment are considered along with possible alternative ways of treating the problem and there-by minimizing these environmental effects. Alter-native antifouling treatments include the use of

mechanical systems (such as rubber balls cleaning the condensor tubes to prevent microfouling caused by bacterial slime deposits), surface treat-ments, and heat treatments (by recycling warmed up cooling water). In many cases more chlorine has been added to treatment systems than was actually needed. (Baker-IVI) W85-02023

MECHANISM OF SEMIFLUIDIZED BED BIOREACTOR FOR BIOLOGICAL PHENOL DEGRADATION,

Ohio State Univ., Columbus. Dept. of Chemical Engineeri L. S. Fan. eering.

L. S. Fan.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-207323,
Price codes: A06 in paper copy, A01 in microfische.
Water Resources Center Completion Report, 1983.
99 p, 34 Fig, 9 Tab, 63 Ref, 1 Append. Project No.
OWRT A-060-OHIO(1).

Descriptors: *Wastewater treatment, *Mass transfer, *Biodegradation, Aeration, *Phenols, Kinetics, *Bioreactors, Bacteria, Organic wastes, Semiflui-

The kinetics of biological phenol degradation and the performance of the bacteria in a packed bed and semifluidized bed reactor were investigated in this research project. Batch studies at three temperatures, 24 degrees C, 35 degrees C, and 45 degrees C, were undertaken to determine the optimum operating temperature. Sewage bacteria acclimated to high phenol concentrations at each temperature were used in these studies. The bacteria were seeded onto various types of packing material for use in the semifluidized and packed bed studies. In the semifluidized bed, the flow of gas and liquid was countercurrent. From the semifluidized bed studies, a decrease in the liquid flow rate from 1500 ml/min to 100 ml/min increased the phenol degradation by approximately 10 percent. rate from 1500 ml/min to 100 ml/min increased the phenol degradation by approximately 10 percent. Investigation was also extended to cover the hydrodynamic behavior of the semifluidized bed. Separate experiments were conducted to study the hydrodynamic behavior of countercurrent flow of gas and liquid in a packed bed. A computational procedure was developed which allows a reasonably accurate prediction of the pressure drop in the semifluidized bed. semifluidize W85-02106

DEHALOGENATION OF THREE CHLORIN-ATED HYDROCARBONS: AMINE-ASSISTED VERSUS METAL-CHELATE ASSISTED,

University of South Florida, Tampa. Chemical and Environmental Management Services Center. For primary bibliographic entry see Field 5F. W85-02121

EFFECT OF CHLORINATION ON ANTIBIOTIC RESISTANCE PROFILES OF SEWAGE-RE-LATED BACTERIA, Ottawa Univ. (Ontario). Dept. of Biology. G. E. Murray, R. S. Tobin, B. Junkins, and D. J. Kushner.

Abplied and Environmental Microbiology, Vol. 48, No. 1, p 73-77, July, 1984. 1 Fig, 5 Tab, 25 Ref. Canadian Dept. of Supplies and Services contract ISU80-00323.

Descriptors: *Chlorination, *Antibiotic resistance, *Wastewater, Effluents, Bacteria, Wastewater treatment, Disinfection.

A total of 1,900 lactose-fermenting bacteria were isolated from raw sewage influent and chlorinated sewage effluent from a sewage treatment plant, as well as from chlorinated and neutralized dilute sewage, before and after a 24-h regrowth period in the laboratory. Of these isolates, 84% were resistant to one or more antibiotics. Chlorination of influent resulted in and increase in the proportion of bacteria resistant to ampicillin and cephalothin, the increase being most marked after regrowth occurred following chlorination. Of the other nine antibiotics tested, chlorination resulted in an inantibiotics tested, chlorination resulted in an in-creased proportion of bacteria resistant to some,

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

but a decrease in the proportion resistant to the remainder. Multiple resistance was found for up to nine antibiotics, especially in regrowth populations. Identification of about 5% of the isolates showed that the highest proportion of Escherichia coli fell in untreated sewage. Some rare and potentially pathogenic species were isolated from chlorinated and regrowth samples, including Yersinia enterocolitica, Yersinia pestis, Pasteurella multocida, and Hafnia alvei. The results indicate that chlorination, while initially lowering the total number of bacteria in sewage, may substantially increase the proportions of antibiotic-resistant, potentially pathogenic organisms. (Author's abstract) W85-02139

5E. Ultimate Disposal Of Wastes

GEOHYDROLOGY OF THE MEADOWBROOK ARTIFICIAL-RECHARGE PROJECT SITE IN EAST MEADOW, NASSAU COUNTY, NEW YORK.

Geological Survey, Albany, NY. Water Resources

For primary bibliographic entry see Field 2F. W85-01774

MUNICIPAL SOLID-WASTE DISPOSAL AND GROUND-WATER QUALITY IN A COASTAL ENVIRONMENT, WEST-CENTRAL FLORIDA, Geological Survey, Tallahassee, FL. Water Re-sources Div.

sources Liv.
M. Fernandez, Jr.
Available from OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225, USGS Water-Resources
Investigations Report 83-4072, 1983. 29 p. 12 Fig, 2

Descriptors: *Landfills, *Water pollution sources, Water quality, Domestic waste, Coastal environ-ment, *Florida, *Solid waste disposal, Groundwat-

er pollution.

Solid waste is defined along with various methods of disposal and the hydrogeologic factors to be considered when locating land-fills is presented. Types of solid waste, composition, and sources are identified. Generation of municipal solid waste in Florida has been estimated at 4.5 pounds per day per person or about 7.8 million tons per year. Leachate is generated when precipitation and ground water percolate through the waste. Gases, mainly carbon dioxide and methane, are also produced. Leachate generally contains high concentrations of dissolved organic and inorganic matter. The two typical hydrogeologic conditions in west-central Florida are (1) permeable sand overlying limestone. These conditions are discussed in relation to leachate migration. Factors in landfill site selection are presented and discussed, followed by a discussion on monitoring landfills. Monitoring of landfills includes the drilling of test holes, measuring physical properties of the corings, installation of monitoring wells, and water-quality monitoring. (USGS) W85-01789 toring. (USGS)

WASTE MANAGEMENT SCENARIOS FOR MINNESOTA'S TWIN CITIES,

BioCycle, Vol. 24, No. 1, p 17-20, January/February, 1983.

Descriptors: *Waste disposal, *Incineration, *Land disposal, *Minnesota, *Composting, Management, Planning, Twin Cities.

Various methods of dealing with wastes in Minne-sota's Twin City area are discussed. Currently employed solutions include landspreading, inciner-ation, and co-composting. The Metropolitan Waste Control Commission operates a regional sewage treatment plant, which generates 80% of the re-gion's sludge. Land application for much of the sludge was used as an interim solution. While this interim solution has now become a successful operinterim solution has now become a successful operation, work on the incineration system is nearing completion using the Zimpro process. In this proc-

ess the sludge is pressure cooked and heat from the initial batches is used to continue thermally treating the other sludge. During the winter all the sludge will be needed to run the incinerators, but during the summer, it may be possible to burn about 50% of the sludge and landspread and/or compost the remainder. Many neighborhoods also have waste management programs. The possible co-composting of both yard/leaf waste and regular garbage with sewage sludge is being studied. Another area of study has been the feasibility of a centralized processing pretreatment facility for platers in the Twin City area. This facility would be designed for small-to medium-sized metal finishers, electroplaters, and printed circuit manufacturing industries who can't afford to comply with discharge requirements on their own. (Baker-IVI) W83-01867

HYDROGEOLOGY AND WATER QUALITY OF SIX LANDFILL SITES IN HILLSBOR-OUGH COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-Geological sources Div.

For primary bibliographic entry see Field 5B. W85-01946

VOLATILE ORGANIC INPUTS FROM AN OCEAN OUTFALL NEAR BARCELONETA, PUERTO RICO, Texas A and M Univ., College Station. Dept. of

Oceanography.
M. C. Kennicutt, II, J. M. Brooks, and T. J.

McDonald. Chemosphere, Vol. 13, No. 4, p 535-548, 1984. 5 Fig. 5 Tab, 11 Ref. NOAA grants 04-8-MO1-55 and NA80RAD00039.

Descriptors: *Waste disposal, *Volatility, *Organic compounds, *Ocean dumping, *Barceloneta, *Puerto Rico, Industrial wastes, Outfalls.

*Puerto Rico, Industrial wastes, Outfalls.

A study was undertaken to compare two methods of ocean disposal (ocean outfall and ocean dumped) using volatile organic compounds (VOCs) as a measure of waste dispersion. The assessment of the environmental consequences of ocean disposal involves four considerations: waste quality and quantity, method of discharge, and discharge location. When wastes are discharged to the ocean a choice has to be made between barging the waste and discharging through an outfall. A major advantage of outfall disposal is that it is less expensive. Environmental costs may be higher, however, because the coastal zone is an area of high productivity and economic use. When industrial wastes are introduced deep into the water column via a coastal outfall, the coastal environment is not readily flushed of the discharged waste, and waste contamination does impinge on the shoreline. When the waste contamins high concentrations of VOCs, as well as high fecal coliforms, it is preferable environmentally to discharge the trations of VOCs, as well as high fecal coliforms, it is preferable environmentally to discharge the waste at the surface in the open ocean because the VOCs are more readily lost to the atmosphere than by introduction at depth, and contamination is less likely to reach the shoreline along an economically useful coastal zone. (Baker-IVI) W85-01963

5F. Water Treatment and **Quality Alteration**

COST AND BENEFITS OF DRINKING WATER TREATMENT, Municipal Environmental Research Lab., Cincin-nati, OH. Drinking Water Research Div. R. M. Clark, J. A. Goodrich, and J. C. Ireland. Journal of Environmental Systems, Vol. 14, No. 1, p 1-30, 1984-85. 15 Fig. 11 Tab, 14 Ref.

Descriptors: *Cost-benefit analysis, *Social costs, *Drinking water, *Water treatment, Cost analysis, Environmental control, Public health, Chlorination, Filtration, Infectious diseases, Activated carbon.

As inflationary and regulatory pressures increase and regulated industries and the public question

the usefulness of investing in environmental control measures, a need to relate environmental control costs to their benefits is more apparent. This article develops a framework for evaluating the costs and benefits of environmental control and preventive public health practices and asks the policy question: How do we achieve the best mix of protection against infectious disease and toxic chemicals in drinking water. In an attempt to answer this question, the costs and benefits of chlorination and filtration are analyzed retrospectively, and the results of this analyzis extended to include a newer technology, granular activated carbon (GAC) filtration. Both a net benefit and cost per life saved approach is used in the analysis. The issue of uncertainty in estimating benefits and the resulting impact on the selection of an optimal strategy is examined. Net benefit associated with chlorination and filtration are shown to be more than adequate for installation of these technologies, with GAC technology, the relative benefits drop. The best cost benefit relationship for GAC technology results when GAC replaces sand in the filtration scheme. Benefits tend to increase with increasing scale of service. (Author's abstract) W85-01649

DETERMINATION OF CHLORINE DIOXIDE AND CHLORITE IN DRINKING-WATER (BESTIMMUNG VON CHLORDIOXID UND CHLORIT IM TRINKWASSER),

Technische Univ., Munich (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie. G. Hartung, and K.-E. Quentin.

Zeitschrift fur Wasser und Abwasser Forschung, Vol. 17, No. 2, p 50-62, 1984. 8 Fig, 4 Tab, 17 Ref.

Descriptors: *Chlorine dioxide, *Chlorite, *Drinking water, *Photometry, Interference, Chlorination, Water treatment.

The photometric determination of iodine at 350 nm after oxidation of iodide by ClO2 at pH 7 or pH 2.5 was shown to be suitable for determination of concentrations of chlorine dioxide down to 0.001 concentrations of chlorine dioxide down to 0.001 mg/. Interfering chlorine can be removed so that chlorite only interferes at pH 2.5. For concentration and isolation CIO2 can be stripped with nitrogen or extracted with hexane. In a similar way chlorite can be determined down to 0.001 mg/ after removing chloride dioxide previously by stripping or extraction. Very small quantities of chlorite can be oxidized with sodium peroxydisulfate to chlorine dioxide, which after concentration is determined photometrically. Variations of the is determined photometrically. Variations of the method are described together with their proce-dures. The methods especially pertain to those concentrations of ClO2 and ClO2(-) being used in concentrations of ClO2 and ClO2(-) being used in waterworks and to these recommendations in the new edition of the Trinkwasser-Außereitungs-Verordnung (chlorine dioxide up to 0.1 mg/l, in excepted cases up to 0.4 mg/l chlorite up to 0.1 mg/l). (Author's abstract) W85-01664

ENTERIC VIRUS LEVELS IN WASTEWATER EFFLUENTS AND SURFACE WATERS IN THE SEVERN TRENT WATER AUTHORITY 1979-

Severn-Trent Water Authority, Birmingham (Eng-

For primary bibliographic entry see Field 5B. W85-01718

FORMATION OF STABLE ORGANIC CHLOR-AMINES DURING THE AQUEOUS CHLORIN-ATION OF CYTOSINE AND 5-METHYLCYTO-SINE.

Georgia Inst. of Tech., Atlanta. School of Civil

Engineering.

J. P. Gould, J. T. Richards, and M. G. Miles.

Water Research, Vol. 18, No. 8, p 991-999, 1984.

11 Fig, 3 Tab, 13 Ref.

Descriptors: *Chlorination, *Cytosine, *Methylcytosine, *Organic chloramines, Hypochlorous acid, Chlorohydrins, Hydrogen ion concentration, Chlorinated hydrocarbons, Chemical reactions.

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

The interaction of aqueous hypochlorous acid with the aminopyrimidines, cytosine and 5-methylcyto-sine has been investigated. Analysis of the reaction mixtures indicated substantial formation of chlo-rine substitution and addition products with little reduction of chlorine to chloride. Very high levels of combined chlorine were observed. Ultraviolet process aboved complex patterns of behavior with of combined chlorine were observed. Ultraviolet spectra showed complex patterns of behavior with peak shifts and intensity changes occurring some cases and full loss of aromaticity in others. The latter process was suggestive of addition of HOCl to double bonds with formation of chlorohydrins. The behavior was found to depend on reaction pH and chlorine to base ratios. Thin layer chromatography revealed complex patterns of stable chloramine formation with the reaction mixture complexity tending to increase with increasing pH and FAC/base ratios. Chemical ionization mass spectra disclosed the existence of a number of organic FAC/base ratios. Chemical ionization mass spectra disclosed the existence of a number of organic chloramines containing up to three chlorine atoms and, in the case of 5-methylcytosine a major ring cleavage and rearrangement product of as yet undefined structure. The half-life for the decay of the combined chlorine was found to be approx. 3.9 days and to be independent of precursor compound and pH. (Author's abstract)

FORMATION AND REMOVAL OF MUTAGEN-IC ACTIVITY DURING DRINKING WATER PREPARATION,

FREFARATION, Rijksinstituut voor Drinkwatervoorziening, Leids-chendam (Netherlands). Chemical Biological Div. H. J. Kool, and C. F. Van Kreijl. Water Research, Vol. 18, No. 8, p 1011-1016, 1984. 5 Fig. 5 Tab, 19 Ref. Netherland Cancer Society grant RID 80-1.

Descriptors: *Mutagenic activity, *Chlorination, *Ozonation, *Drinking water, Water treatment, Ames test, Filtration, Sand filters, Activated

The influence of different treatment processes on the mutagenic activity (Ames test) and some chem-ical parameters in water were investigated in a few waterworks. Application of a chlorine treatment generally increased the direct and promutagenic activity, but the extent increase proved to be de-pendent on the type of water chlorinated. The use of ozone in the preparation of drinking water de-creased the mutagenic activity in the water. The extent reduction was also dependent on the type of extent reduction was also dependent on the type of water ozonated. Dune filtration greatly reduced the mutagenic activity. Slow sand filtration could not be evaluated, because of the toxicity of the organic concentrates for the bacterial strains. Granular activated carbon filters, in operation for about 1 year, reduced the mutagenic activity below the detection level. A similar filter which below the detection level. A similar inter which has operated for more than 1.5 years in a pilot plant, showed a breakthrough of mutagenic activity suggesting that carbon filters are able to remove organic mutagens for a limited period. The results of the chemical parameters measured before and after the different treatment processes showed that none of these parameters were a reliable indicator for the mutagenic activity. (Author's abstract) W85-01728

CHLORINE AS AN ALGICIDE IN A CONVEN-TIONAL WATER TREATMENT PLANT, American Univ., Beirut (Lebanon). Dept. of Envi-ronmental Health.

J. Ibrahim, L. Squires, H. Mitwalli, and M. Taha. International Journal of Environmental Studies, Vol. 20, No. 1, p 41-46, 1982. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Water treatment facilities, *Algicides, *Chlorination, *Beirut, *Lebanon, Prechlorination, Algal growth, Tropical regions.

The Beirut, Lebanon, Water Treatment Plant is of The Beirut, Lebanon, Water Treatment Plant is of conventional design, and processes between 147,000 and 190,000 cu m of water per day. Algae grow abundantly in the various treatment units of the plant, particularly during spring and summer. Algae in the water entering the plant and algae growing within the plant cause severe management and operational difficulties. A study was conducted to determine the dose of chlorine lethal to the

algae which were causing operational difficulties. In laboratory experiments, a single dose of 1.8 mg/l of chlorine was sufficient to kill all the algal taxa growing in the plant. If the chlorine dose was regenerated to the original concentration every 24 hours, then a dose of 1.2 mg/l was sufficient. In field studies, continuous dosing of chloride to maintain a residual chlorine level of 0.8 mg/l was found lethal to the algal taxa. Prechlorination is therefore recommended as an effective method for the control of algal growth in conventional water treatment plants in the tropics. (Moore-IVI) W85-01749

MICROBIAL CONTAMINATION OF POTA-BLE WATER IN DISTRIBUTION SYSTEMS, Vermont Univ., Burlington. Dept. of Civil and Mechanical Engineering.

Mechanical Engineering.
D. R. Hemenway.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-202456,
Price codes: A03 in paper copy, A01 in microfiche.
Vermont Water Resources Research Center Completion Report, September 1983. 25 p. 2 Tab, 5
Ref, 1 Append. Project No. OWRT A-045-VT(1).

Descriptors: *Drinking water, *Potable water, Water distribution systems, *Coliforms, Water conveyance, Enterobacter, Psuedomonas, Flavobacterium, Citrobacter, Aeromonas, Serratia, Klebsiella, Bacteria, *Vermont, Microorganisms, Microbiological studies, Champlain, Rutland City.

Drinking water from two sites in Vermont were sampled and analyzed to examine the relationships among water source, prevailing treatment practices and the quantity and identity of the microorganisms in the distribution systems. Samples of raw water, or settled raw water water immediately ganisms in the distribution systems. Samples of raw water or settled raw water, water immediately after treatment, and at three locations at the end of the distributions systems were taken from the Rutland City water system and the Champlain Water District system. Turbidity, free and total chlorine, pH, conductivity, total coliform count and low power microscopic estimation of the bacteriological densities were performed on each sample. Per-dominant organisms from the total and fecal coliform and standard plate counts were routinely isolated and identified. Coliform bacteria were not found in the distribution network of either system during the sampling period. Fecal coliform in the found in the distribution network of either system during the sampling period. Fecal coliform in the raw water at Champlain Water District accounted for approximately 9% of the total coliform count, while in Rutland no fecal coliform were found after prechlorination of the raw water in this system. Seventy-four percent of the organisms identified in the treated water belonged to the Family Pseudomonadaceae. Presumably these organisms contrast the distribution was the contrast the distribution was the contrast the distribution was contrast the distribution was the coliforn the distribution was the distr ganisms colonized the distribution syste W85-01796

STATUS OF REVERSE OSMOSIS VS. ION EXCHANGE FOR PETROLEUM/PETROCHEMICAL UTILITIES,
H. S. Bourgeois, Jr.
Industrial Water Engineering, Vol. 21, No. 2, p 14-18, 1984. 2 Fig, 4 Tab, 2 Ref.

Descriptors: *Reverse osmosis, *Ion exchange, *Water treatment, *Industrial water, Dissolved solids, Particulates, Membrane processes, Pretreatment, Oil industry.

With the advent of Reverse Osmosis in the late 1960's, an alternative process to straight ion exchange became available to industry for the removal of dissolved solids. Reverse Osmosis (RO) moval of dissolved solids. Reverse Osmosis (RO) has been utilized extensively in the electronics industry for the preparation of 'ultra-pure' water used primarily in the manufacture of semi-conductors. RO provides the added advantage of essentially complete particulate removal, along with dissolved solids removal, prior to final polishing by ion exchange. There also has been widespread application of RO in conjunction with ion exchange in the electric utility industry to provide feedwater for high pressure steam generators. To date, Reverse Osmosis has seen very limited use in this country in the petroleum/petrochemical industry. This is probably the result of the availability of good quality water supplies in the areas where

these industries are located. Since 1979, the costs of regeneration chemicals and ion exchange resins have increased rapidly compared to R.O. membranes and Reverse Osmosis with ion exchange polishing has become economically attractive when compared to straight ion exchange at lower dissolved solids levels. The most important factor in the design and successful operation of a R.O. system is proper pretreatment to protect the membrane against fouling. The principle aspects of pretreatment are discussed followed by an economic evaluation of Reverse Osmosis versus straight ion exchange for three typical Gulf Coast water supplies. (Author's abstract)

DEVELOPMENT OF THE CONDITION OF THE BALDEGGERSEE (1900 TO 1980) AND THE EFFECT OF INTRALAKE PROCEDURES (DIE ZUSTANDSENTWICKLUNG DIS BAL-DEGGERSES (1900 BIS 1980) UND DIE AUS-WIRKUNG VON SEEINTERNEN MASSNAH-MEN),

ary bibliographic entry see Field 5C. For primar W85-01865

STATE-OF-THE-ART FOR ELECTRONIC GRADE ULTRAPURE WATER MANUFAC-TURING AND DISTRIBUTION, PART I,

Anatel Instrument Corp., Boulder, CO.

Journal of Environmental Sciences, Vol. 27, No. 4, p 22-26, July/August, 1984. 4 Tab.

Descriptors: *Water treatment, *Ultrapure water, Standards, Monitoring, Trace elements, Water quality control, Electronics industry, Reverse ososis. Ion exchange.

Ultrapure water is essential for producing semiconductor devices. The methods of monitoring trace contaminants, materials of construction, and distribution from the central production area to points of use are very important in designing the right system. Standards are being proposed for levels of water quality by organizations such as the American Society for Testing and Materials to assist the manufacturing and engineering personnel. In the selection of primary treatment, the basic question of reverse osmosis versus ion exchange economics of reverse osmosis versus ion exchange economics is a never-ending discussion. In the 50-300 milligrams of total dissolved solids per litter range, a decision must be based on the type of contaminants to be removed from the water system. If extensive pretreatment is required to protect the reverse osmosis membrane, then deionization should be considered. If the ultrafiltration characteristics of considered. It the ultraintiation characteristics of the RO membrane outweigh the other facts, reverse osmosis is the obvious choice. When the water reaches the polishing stage, the majority of constituents has been reduced to a very low level. The ionic concentration has been controlled and final removal of trace amounts of the dissolved inorganic material requires special steps. It is a misconception to feel that the water has been treated to such a point that the other contaminants have likewise been reduced. (Baker-IVI) W85-01873

EXECUTION OF SOCIALIST BUSINESS MAN-AGEMENT IN THE CONTINUATION OF THE COLBITZ MOVEMENT (DIE DURCHSETZING DER SOZIALISTISCHEN BETRIEBSWIRTS-CHAFT IN FORTFUHRUNG DER COLBITZER

VEB Wasserversorgung und Abwasserbehand-lung, Magdeburg (German, D.R.) R. Wernecke. Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 17-18, January, 1984. 4 Ref.

Descriptors: *Water treatment, *Colbitz, *East Germany, Costs, Management, Water use, Optimi-zation, Water treatment facilities, Automation.

At the Colbitz waterworks, German Democratic Republic, efforts were begun at the end of 1970s to increase performance. Waterworks capacity was increased by 154,000 cu m/day between 1976 and

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration-Group 5F

1982, the goal being a total increase of 204,600 cu m/day by 1985. During the same period, water losses increased from 10 to 11%, supply of water demand rose from 75.9 to 92.0%, 68 jobs were eliminated, and annual production costs dropped by 1.0-1.5 million Marks. This was achieved by improving weak spots in the production process without expanding the facility. The second step of the movement consisted of rationalization of water the movement consisted of rationalization of water use and optimization of water network operation. Optimal models for the Colbitz-Letzlinger Heide underground reservoir and operation of the Magdeburg network were developed. Analyses were made of scientific and technological developments with regard to their impact on the workforce and on the quality of water and water facilities. Workers will have to be more highly educated in future, as the introduction of micro-electronics is inevitable. For further development of the Colbitz movement, the Magdeburg water-supply and wastewater-treatment facility was given the task of finding new methods of automation and process control. Intensive analyses of the production process were carried out, in particular, analysis of existing conditions as a basis for the development of a concept for optimal production. The introduction of an achievement-oriented pay scale is important. (Cish-IVI) tant. (Gish-IVI) W85-01876

CONSTRUCTION OF RATIONALIZATION EQUIPMENT AT THE ROSTOCK WATER-SUPPLY AND WASTEWATER-TREATMENT FACILITY (RATIONALISIERUNGSMITTEL-BAU IM VEB WASSERVERSORGUNG UND ABWASSERBEHANDLUNG ROSTOCK), VEB Wasserversorgung und Abwasserbehandlung Rostok (Campa)

VEB Wasserversorgung und Abwa lung, Rostock (German, D.R.). G. Schofer.

Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 19-20, January, 1984. 3 Fig.

Descriptors: *Water treatment facilities, *Wastewater treatment facilities, *Rostock, *East Germany, Chlorination, Water treatment, Filtration, Automation

A workshop was given to the Rostock water-supply and wastewater-treatment facility for the purpose of building rationalization equipment be-ginning in 1977. During its first year, the workshop produced equipment worth 70,000 Marks, increas-ing to 338,000 Marks in 1980. Construction of rationalization equipment on-site plays a large part in the 1981-85 five year plan, especially in terms of industry-specific items that cannot be completed elsewhere or provided by East German businesses, modernizing existing equipment, and producing elsewhere or provided by East German businesses, modernizing existing equipment, and producing spare parts. At Rostock, industry-specific equipment has been developed in innovator collectives and has resulted in the construction of a transportable drinking water treatment station, a transportable pressure station, a chlorine-dosage station that can be mounted on a trailer, electronic transmitter measurement, and automatic filter aeration and ventilation. The water-treatment station was designed for backup during reconstruction or heavy pollution but could also be used as an independent waterworks in rural areas. (Gish-IVI) W85-01877

COMPUTERIZED DISTRIBUTION RECORDS-

COMPUTERIZED DISTRIBUTION RECORDS-CADD PAVES THE WAY, Donohue and Associates, Inc., Waukesha, WI. J. F. Curtiss, and P. A. Lohmiller. Journal of the American Water Works Associa-tion, Vol. 76, No. 7, p 56-61, July, 1984. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Computers, *Water distribution, *Leakage, Water audit, Mapping, Sewer systems, Water conveyance.

The findings of a water audit and leak detection investigation generated input for a new computer-aided drafting and design system (CADD) for the city of Des Plaines, Ill. Installation of the computcity of Des riantes, III. Installation of the computerized system will upgrade the usefulness and accuracy of documents pertaining to the city's water and sewer systems. Immediate benefits were realized from the discovery of significant leakage, and

long-range benefits will be realized from the inher-ent flexibility of the CADD system and the ease with which up-to-date records can be maintained. Graphic overlays on base maps of the city can be generated in hard-copy form to produce the graph-ic and nongraphic data needed for a given use. These data, stored in CADD, will also be of use to other municipal departments. (Author's abstract) W85.01902

MICROCOMPUTER PROGRAMS FOR DE-SIGNING WATER SYSTEMS, Public Works Dept. of Malaysia, Kuantan. For primary bibliographic entry see Field 8A. W85-01903

CALIBRATING WATER SYSTEM MODELS, Denver Water Dept., CO. A. L. Cesario, and J. O. Davis. Journal of the American Water Works Associa-tion, Vol. 76, No. 7, p 66-69, July, 1984. 8 Ref.

Descriptors: *Water conveyance, *Model studies, *Computers, Water distribution, Calibration.

Calibration of network models is an integral part of water distribution system analysis. Telemetry data and field measurements of the system provide base data for calibration, but computer programs that automatically extract and compare pertinent data with simulated values can aid the process. Calibration establishes the credibility of the model that is used as a benchmark case for studies and as a sendictor. Suppose of error or inscruperies includes predictor. Sources of error or inaccuracies include improper network definition or demand distribuimproper network definition or demand distribu-tion, or both. The degree of confidence as a model should be fine-tuned is related to the complexity of the model and to the purpose of the study. A thorough knowledge of operation and performance of the system is gained through the process of calibration. This may be more important than the degree of accuracy of calibration, since modeling is often more concerned with changes than with ab-solute values. (Moore-IVI) W85-01904

COMPUTER MODELING IN WATER SYSTEM PLANNING AND DESIGN, Krebs (Paul B.) and Associates, Inc., Birmingham,

R. U. Harris. Journal of the American Water Works Associa-tion, Vol. 76, No. 7, p 78-81, July, 1984. 2 Fig, 7 Ref.

Descriptors: *Computer models, *Water distribu-tion, *Design, *Planning, Simulation, Model stud-ies, Water demand, Water use, Hydraulic design, Emergency demand.

Benefits that can be derived from the use of hydraulic network computer modeling and analysis in the planning and design of water systems include: data management; evaluation of variations in consumption; simulation of emergency water demands; effect of new water demands; optimization of system operation; long-range planning, facility design, and comprehensive knowledge of the system. Case studies of applications in Charlottes-ville, Va., Decatur, Ala., and Opelika, Ala are presented. The availability of low-cost, efficient hydraulic network analysis computer software, and the continuing reduction in the cost of computer hardware, enhances the benefits of simulating the hydraulic conditions of water systems with properhydraulic conditions of water systems with properly developed and calibrated models. (Moore-IVI) W85-01906

COMPUTER-ASSISTED WATER SYSTEM ANALYSIS AND DESIGN FOR CHARLESTON.

S.C., CH2M Hill, Montgomery, AL. R. E. Topping, and R. J. Puccia. Journal of the American Water Works Associa-tion, Vol. 76, No. 7, p 83-89, July, 1984. 3 Fig. 4 Tab, 5 Ref.

Descriptors: *Computer models, *Water distribu-tion, *Charleston, *South Carolina, Cost analysis, Pipes, Water storage, Pumps, Energy costs.

A computer model was developed and used to analyze all components of the Charleston, S.C. water distribution system in anticipation of improving the system to meet future demands. After limitations and deficiencies were identified, cost-effective improvements to pining storage facilities. imitations and dericiencies were identified, cost-effective improvements to piping, storage facilities, service pumps, and booster pumps were recom-mended. An improved operations program, which included a power management plan that resulted in substantial savings in energy costs, was also deter-mined with the computer model. (Author's abstract) W85-01907

FLOCCULATION MODEL TESTING: PARTI-CLE SIZES IN A SOFTENING PLANT, Texas Univ. at Austin. Dept. of Civil Engineering. D. F. Lawler, and D. R. Wilkes. Journal of the American Water Works Associa-tion, Vol. 76, No. 7, p 90-97, July, 1984. 13 Fig. 1 Tab, 25 Ref. EPA grant R-808192-01.

Descriptors: *Flocculation, *Particle size, *Water treatment, Mathematical models, Fluid shear, Turbidity, Suspended solids.

Designing an efficient and cost-effective floccula-tion unit has always been a challenge to engineers. Measurements of its capability have necessarily been after the fact - examining turbidity or sus-pended solids concentration after settling. Particles size-distribution analyses during flocculation more closely reflect the actual process but are difficult, time-consuming, and rouge to sampling errors. Retime-consuming, and prone to sampling errors. Re-search using Smoluchowski's equation has led to a search using Smoluchowski's equation has led to a mathematical model for the process of flocculation. This model was tested against actual treatment plant performance for particle size distribution. Using different conditions, the model successfully predicted changes in small or large particles, but not both. The model compared favorably with most experimental results but needs improvement to predict the effects of changes in fluid shear and particle concentration. (Author's abstract) W85-01908

LOWER DETECTION LIMITS FOUND FOR CHLORINE DIOXIDE CONTAMINANTS,

Miami Univ., Oxford, OH. Dept. of Chemistry. G. Gordon, and Y. Ikeda.

Journal of the American Water Works Associated the American Water Water Works Associated the American Water Wate

tion, Vol. 76, No. 7, p 98-101, July, 1984. 3 Tab, 23

Descriptors: *Chlorates, *Chlorites, *Chlorine dioxide, Water analysis, Disinfection, Water treatment, Hypochlorites, Idometry, Potentiometry.

Chlorine dioxide disinfection of water eliminates critinal methane formation but generates chlorate and chlorite ions. Government regulations under consideration would require the removal of these by-products to levels for which no detection methods exist. An iodometric-potentiometric method is developed to measure chlorate, chlorite, and hypochlorite ions, even in mixtures that contain high hypochlorite ion concentrations such as those frehypochlorite ion concentrations such as more requently observed in a water treatment plant. This method can also be used to determine directly the concentration of chlorite ion, in contrast to other indirect methods. Measurements of synthetic mixtures that contain these ions can be carried out with an accuracy of + or - 3% at the 0.3-mg/L level, with lower limits of 0.1 mg/L. (Moore-IVI)

SEDIMENTATION SUCCESS FROM MODI-FIED JAR TESTS,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.

G. D. Reed, and D. A. Reece.
Journal of the American Water Works Association, Vol. 76, No. 7, p 101-105, July, 1984. 8 Fig. 1

Descriptors: *Sedimentation, *Jar tests, *Wastewater treatment, Turbidity, Filtration, Flocculants, Hydraulic comparison equation, Flow

Field 5-WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

Delivery of clear water from settling basins to filtration systems is important for the smooth operation of a treatment plant. But operators work at a disadvantage when they cannot determine what is happening during the sedimentation process. Incomplete settling allows turbid outflows to reach filters, shortening their runs and adding to water quality costs. A modified jar test method for modeling basin behavior has been designed. It uses a hydraulic comparison equation sensitive to basin flow rates, water residence times, and flocculant dosages. When properly calibrated, it can reflect actual basin performance, detect problems, and point to areas where solutions may be found. (Author's abstract) W85-01910

ANN ARBOR CONTROLS TRIHALOMETH-ANES, Michigan Dept. of Public Health, Lansing.

Michigan Dept. of Public Health, Lansing. R. S. Sacks.

Journal of the American Water Works Associa-tion, Vol. 76, No.7, p 105-108, July, 1984. 6 Fig, 3

Descriptors: *Trihalomethanes, *Water treatment, *Ann Arbor, *Michigan, Drinking water, Disinfection, Chlorine, Chloramines, Anhydrous ammonia, Halogenated hydrocarbons.

A maximum contaminant level (MCL) was established by the EPA for total trihalomethanes (TTHMs) in public drinking water supplies. Many water treatment plants need new methods to control the formation of trihalomethanes as by-products of existing disinfection practices. The city of Ann Arbor, Michigan experimented with a variety of disinfection schemes using chlorine and chloramines. Anhydrous ammonia, added to the raw water after prechlorination, reduced TTHM concentrations to required levels without sacrificing bacteriologic quality, as determined by routing plate count samples. (Moore-IVI)

EFFECT OF TREATMENT WITH A COMMER-CIAL BACTERIAL SUSPENSION ON WATER QUALITY IN CHANNEL CATFISH PONDS, Auburn Univ., AL. Dept. of Fisheries and Allied

C. E. Boyd, W. D. Hollerman, J. A. Plumb, and M. Saced.

Progressive Fish Culturist, Vol. 46, No. 1, p 36-40, January, 1984. 3 Fig. 1 Tab, 11 Ref.

Descriptors: *Catfish farming, *Bacteria, *Biological treatment, *Water pollution treatment, Saprophytic bacteria, Bacillus, Nitrobacter, Pseudomonas, Aerobacter, Cellulomonas, Rhodopseudomonas, Nitrogen, Phosphorus, Chemical oxygen demand, Biochemical oxygen demand, Chlorophyll a, Cyanophyta, Phytoplankton, Fish farming, Austenlius

Water quality deterioration and off-flavor in fish are common problems in the commercial culture of channel catfish (Ictalurus punctatus). Four I, punctatus points were treated with a commercial suspension of saprophytic bacteria (Aqua-Bacta-Aid) consisting of Bacillus, Nitrobacter, Pseudomonas (two strains), Aerobacter, Cellulomonas, and Rhodopseudomonas. Concentrations of inorganic nitrogen, total phosphorus, chemical oxygen demand, 5-day biochemical oxygen demand, and chlorophyll alpha; numbers of bacteria and phytoplankters per milliliter; and percentage of bluegreen algae did not differ significantly (P > 0.05) between treatments on any sampling date. On three sampling mot differ significantly (P > 0.05) between treatments on any sampling date. On three sampling dates between mid July and mid August, there were significantly higher (P < 0.05) dissolved oxygen concentrations in the morning and in the afternoon on ponds treated with the bacterial suspension. Fish production did not differ between treatments (P > 0.1). The bacteria applied in the suspension are common saprophytic bacteria that are known to inhabit freshwater and terrestrial environments. The quantity of bacteria applied was quite insignificant compared to the natural bacterial community. (Collier-IVI)

DATA BANK FOR WATERWORKS AND FA-CILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LO-SUNGSKONZEPTION), Institut fuer Wasserwirtschaft, Berlin (German

E. Tutsch, and H. Weruschek. Wasserwirtschaft-Wassertechnik, Vol 33, No. 2, p 46-49, February, 1983. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Water treatment facilities, *Computers, *East Germany, Data processing, Data storage and retrieval, Data collections, Planning, Water

The goal of a data bank projected for German Democratic Republic waterworks and facilities is to provide decision-making information with regard to materials and energy use, to improve the cost-benefit ratio, and to secure the water supply. The data bank will be instrumental in the develop-The data bank will be instrumental in the development of one-year, five-year, and long-range plans. Studies of user information needs showed that data analysis should be supplied in the areas of facility capacity, water quality, technology and operating regimes, planning for facility construction/expansion, and maintenance. The projected data bank will be centralized. Primary data will be very heterogeneous, comprising about 80% of total stored data (the remaining 20% being results and control data) and consisting of core data, e.g., technological, construction, economic, and capacity figures; aperiodic variable data, e.g., damages, run times; and periodic variable data, e.g., water quality, groundwater conditions, energy consumpquality, groundwater conditions, energy consump-tion. The project will require a mainframe comput-er; (an ESER ES 1040 or 1055). Four developmener; (an ESER ES 1040 or 1055). Four developmental stages are planned: creation of core data from waterworks, pressure increasing facilities, reservoirs, and water-supply areas, of the analysis call-up system, frame program, and universal analysis program system; integration of data from water-treatment plants and completion of data from water-treatment plants and completion of data search capability; integration of water-conveyance data and capability for input and output via CRT. (Gish-IVI)

OBSERVATIONS FROM THE TEST OPERATION OF AN ION-EXCHANGE FACILITY FOR NITRATE REMOVAL IN DRINKING WATER TREATMENT (ERFAHRUNGEN AUS DEM ERPROBENGSBETRIEB EINER IONEN-AUSTAUSCHERANLAGE ZUR NITRATELI-MINATION IN DER TRINKWASSERAUFBER-

EITUNG), Technische Univ., Dresden (German D.R.). Bereich Hydrobiologie. K. Wiegleb, C. Scholze, S. Bierhals, and H. Elsner. Wasserwirtschaft-Wassertechnik, Vol. 33, No. 2, p 69-70, February, 1983. 1 Tab, 5 Ref.

Descriptors: *Ion exchange, *Nitrates, *Water treatment, *Gera, *East Germany, Drinking water, Chlorides, Regeneration, Automation.

An ion-exchange facility (IE) for the removal of nitrate in water treatment has been in use since 1980 at the Gera (German Democratic Republic) 1980 at the Gera (German Democratic Republic) water- and wastewater-treatment plant. Its capacity is 200 cu m/-day. Before treatment, the water contains 40-70 mg/l NO3(-) and 12-30 mg/l Cl(-). Expressed in effective volume capacity (EVC), nitrate elimination corresponded well to a previously published model, despite differing operating conditions. Nitrate levels in treated water were depending on regenerating conditions 10-18 mg/l, which was 2-7 mg/l above those predicted for small facilities. These results were not achieved and required a longer operating cycle. The increase in chloride produced by the IE in treated water also corresponded well to the published theory with levels of 80-120 mg/l. MgCl2 brine was chosen as the regeneration chemical, so that theory with levels of 80-120 mg/l. MgCl2 brine was chosen as the regeneration chemical, so that the concentrated portion of wastewater produced by regeneration of total wastewater (about 16%) could be used for melting snow on the streets. The concentrated wastewater consisted of eluriate and rinse water, which was collected separately from the remaining regeneration wastewater and con-

tained > 5-10 g/l chloride (10-15% salt solution). Frequent problems occurred in automatic nitrate measurement, requiring changing the membrane, refilling the electrode with electrolytes, and removing air bubbles from the reference electrode. Total automation or regeneration every 3-7 days is recommended for small facilities to ensure economical operation and compliance with standards for nitrate in drinking water. (Gish-IVI) W85-01974

APPROPRIATE WATER SUPPLY TECHNOL-OGY FOR DEVELOPING COUNTRIES,

Aqua, No. 1, p 11-18, 1983. 9 Fig.

Descriptors: *Water supply development, *Developing countries, *Ethiopia, Hydrams, Ponds, Windmills, Springs, Pumps, Dams, Drinking water, Storage reservoirs, Water storage, Cisterns, Appropriate technology.

In Ethiopia only 4 to 5% of the people in rural areas have access to drinking water, and it is unlikely that the entire population of the country will have access to potable drinking water in the next few decades. Innovative practices within the capacity of the community to implement can lead to universal use of potable drinking water and consequent improvement in health standards. Existing sources of supply of water can be used with improvements that enable communities to use the same water but in an uncontaminated form as per acceptable standards. Appropriate technologies consist of use of ponds, spring development, hydrams, windmills, current water lift pumps, rain water storage, subsurface dams, and monitoring of ground water resources in drought affected areas. (Wheatley-IVI)

PRACTICAL WATER TREATMENT FOR COM-MUNITIES IN DEVELOPING COUNTRIES,

North Carolina Univ. at Chapel Hill. Area Health Education Centers Program. D. A. Okun, and C. R. Schulz.

Aqua, No. 1, p 23-26, 1983. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Water treatment, *Appropriate technology, *Developing countries, Economic aspects, Filtration, Coagulation, Sedimentation, Coagulants, Flocculation, Groundwater, Drinking water.

Rather than transferring water treatment technology from industrialized countries to developing countries, simple low maintenance methods are more practical. Groundwater is the preferred choice for community water supplies, as it generally does not require treatment. If no suitable aquifers are available, relatively clear waters from lakes or streams are best treated by slow sand filtration. Pretreatment may be provided by plain sedimentation or horizontal roughing filters prior to slow sand filtration. Only as a last resort should sedimentation or horizontal roughing filters prior to slow sand filtration. Only as a last resort should chemical coagulation and rapid sand filtration be adopted. Even then, only simple, practical technologies such as hydraulic rapid mixing and floculation, horizontal-flow sedimentation, and manually operated filters should be used. Methods of utilizing self-backwashing filters are suggested incorporating the flow from other filter systems and aling self-backwashing filters are suggested incorporating the flow from other filter systems and altered water levels. The use of natural coagulants in water treatment is one economic technology presented. Locally available plant materials can be used, such as seeds of the nirmali tree, extracts from the tamarind tree, guar plant, and red sorella plant. Fenugreek and lentils can be utilized for effective coagulants. Chitosan from exoskeletons of arthropods is one of the most effective coagulants available. W85-01983

WATER SUPPLY OF ALEXANDRIA EGYPT, Zurich Water Supply (Switzerland).

M. Schalekamp.
Aqua, Vol. 1983, No. 1, p 31-41, 1983. 20 Fig, 4
Ref. (In English and French).

Descriptors: *Water treatment, *Potable water, *Egypt, *Alexandria, Nile River, Canals, Flocculation, Coagulation, Settling basins, Water supply development.

Alexandria, Egypt, obtains its water primarily from the Nile River. Because of evaporation and other water loss mechanisms, most of this water is transported via artificial canals. Water treatment is relatively simple: flocculation and filtration. A review of the main water treatment facilities is given. An expansion of water treatment and delivery systems is underway. New pumping plants and pipelines are being constructed with more that 70 million Egyptian pounds being spent from 1978 to 1981. In order to meet the forecasted needs for high quality water for Alexandria and environs, extensive construction and financial plans are being formulated. (Wheatley-IVI)

ALL ABOUT OZONE - ITS ADVANTAGES AND DISADVANTAGES IN TREATING WATER,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Aqua, No. 3, p 89-96, 1983. 38 Fig, 21 Ref.

Descriptors: *Water treatment, *Ozonation, *Switzerland, Review, Disinfection, Monitoring, Ozone, zerland, Review Drinking water.

The history of the use of ozone in Switzerland as an agent for water treatment is briefly reviewed. Tests conducted in Zurich and St. Gall reveal that soundly-treated and ozonized water should in no way enhance regermination of microorganisms in the water mains any more than nonozonized water. way enhance regermination of microorganisms in the water mains any more than nonconized water. This is confirmed also by those Swiss waterworks which ozonize their ground and spring water and do not notice any form of regermination in their water mains. A comparison is made of the effects of treating water with 1 or 5 mm ozone/liter. With regard to the destruction of bacteria and inactiva-tion of viruses in water of not too high a degree of contamination, a higher concentration of ozone than 1.0 to 1.5 is not needed. Before selecting the proper dosage, an exact analysis is needed as to proper dosage, an exact analysis is needed as to what the ozone is to be required to do. Ways to monitor and control the ozone concentration of the water and in the exhaust air of treatment plants are described. (Baker-IVI)

STUDY OF MUTAGENIC ACTIVITY IN WATER IN A PROGRESSIVE OZONATION UNIT (ETUDE DU CARACTERE MUTAGENE UNIT (ETUDIE DU CARACTERE MUTAGENE DE L'EAU DANS UNE FILLERE DE PRODUC-TION A OZONATION ESTAGEE), Compagnie Generale des Eaux, Paris (France). M. M. Bourbigot, J. L. Paquin, L. H. Pottenger, M. F. Blech, and P. Hartemann. Aqua, No. 3, p 99-102, 1983. 3 Fig, 2 Tab, 13 Ref.

Descriptors: *Ozonation, *Mutagenic activity, *Water treatment, Drinking water, Activated carbon, Chlorination, Toxicity.

Samples of water were collected at various points along a drinking water treatment process which includes several ozonation stages, activated carbon includes several ozonation stages, activated carbon filtration and postchlorination. They were concentrated on XAD-4 and XAD-8 resins (x 700 at 10,000), and eluated with DMSO. The concentrates were assayed o two strains of Salmonella typhimurium (TA 98 and TA 100) and on Chinese hamster lung cells (V79). The mutagenecity test on V 79 cells was more sensitive and provided more information than the bacteria test, and allowed determination of mutagenic institute and promoter. determination of mutagenic, initiator and promoter activities. These appeared only in the raw river and at the head of the treatment line. With the bacteria test, the positive results were obtained only on strain TA 98. No mutagenic activity was found in samples of water from the final treatment stages. The results obtained with ozonated water seemed to indicate that optimization of ozone treatment improves the water's characteristics with respect to potentially mutagenic organic molecules. With an adequate ozone dosage, the mutagenic and promoter activities disappear. (Author's abstract) W85-01987 NICE ON THE FRENCH RIVIERA - THE BIRTHPLACE OF DRINKING WATER TREATMENT WITH OZONE (NICE, SUR LA RIVIERA FRANCAISE - BERCEAU DU TRAITEMENT DE L'EAU PAR L'OZONE), Compagnie Generale des Eaux, Paris (France). P. Decourcelle. Aqua, No. 3, p 105-110, 1983. 9 Fig.

Descriptors: "Nice, "France, "French Riviera, "Ozonation, "Drinking water, "Water treatment facilities, Disinfection, Filtration, History.

It was in 1904 that the Nice Administration decided to provide the municipal waterworks with facilities for disinfection of water with zoone - the very first in the world. The plant was also to serve as a center for the study of effects of ozone on water, carried out by Marius-Paul Otto, a researcher from Nice. The waterworks was named Bon-Voyage and, at the start provided treatment at a rate of 100 cu m/h. Following receipt of favorable results, the plant's production rate was increased several fold in 1907 to exceed 22,500 cu m/day, and the Nice Administration went ahead with construction of a waterworks using ozonation at Rimiez; then again in 1925, a third one at Saint-Pierre de Feric. The latter two could each accommodate a disinfection rate of 13,000 cu m/day. Soon after, in rapid succession, ozone disinfection It was in 1904 that the Nice Administration decid-Pierre de Feric. The latter two could each accommodate a disinfection rate of 13,000 cu m/day. Soon after, in rapid succession, ozone disinfection procedures were adopted for the use in all cities on the French Riviera situated between Nice and Menton. It is common knowledge now that the popularity of ozone has since spread throughout the world. Continued population growth had, by 1935, necessitated supplementing the surface water supply with groundwater sources which were derived, by a system of wells installed along the riverbank, from aquifers in the Var region. Thus, a pumping rate of 90,000 cu m/day has been attained with a water made naturally potable thanks to the good filtration capacity of the Var gravel beds. In 1969, the municipal administration decided to replace the three waterworks employing ozonation (as they now had become insufficient to meet city needs and the equipment was timeworn) with only one plant, able to function at a rate of 90,000 cu m/day; the Super-Rimiez Treatment Plant, inaugurated in 1972. Water here is treated using the latest techniques including, of course, ozonation. The architecture and landscaping of this waterworks have been especially successful. In 1982, the Jean Moreno plant producing 90,000 cu m of potable water per day, including an ozonation stage, was inaugurated. (Author's abstract)

CONTROL OF METAL CONTAMINANTS IN DRINKING WATER IN DENMARK, Korrosinecentralen ATV, Glostrup (Denmark). Aqua, No. 4, p 173-182, 1983. 15 Fig, 15 Ref.

Descriptors: *Drinking water, *Denmark, *Plumbing, *Trace metals, *Heavy metals, Domestic water, Lead, Cadmium, Nickel, Copper, Zinc.

Traces of metals are dissolved when water is transported in mains and in house installations. Some of these metals are toxic at sufficiently high concenthese metals are toxic at sufficiently high concen-trations. Even when lead pipes are not used, lead can be picked up from house installations in con-siderable amounts. Cadmium can be found in small amounts in both pipes and fittings, but it can and should be avoided. High concentrations of other metals such as nickel, copper and zinc should be prevented in drinking water. Field tests were made on metal nickun from salvanized steel pines of prevented in drinking water. Field tests were made on metal pick-up from galvanized steel pipes of different manufacture, from brasses and from gun metal. Observations were made in three different types of water over a six-month period. A modified test method was developed for judging the magnitude of metal pick-up from fittings in drinking water installations. Pick-up of lead and cadmium from new house installations in Denmark is kept sufficiently low by the following measures: the use of lead-containing soft solder or cadmium-containing brazing metal for joining copper tubes is forbidden; and only approved fittings, tap valves, and other equipment to be installed may be used. The approval procedure includes a test for cadmium and lead pick-up. (Author's abstract) W85-01993 REPORT ON THE WATER SUPPLY OF THE PEOPLE'S REPUBLIC OF CHINA, Zurich Water Supply (Switzerland).
M. Schalekamp. Aqua, No. 5, p 205-212, 1983. 30 Fig. 6 Ref.

Descriptors: *China, *Water supply, *Drinking water, *Water management, Resources management, Water resources development, Water supply

For the last four thousand years China has been the water-problem country par excellence. There were either big droughts or catastropic floods, which destroyed agricultural growth. Today, after the most immense effort - e.g. for the prevention of flood catastrophies 160 000 km of dams have been constructed along the rivers and more than 10 000 storage lakes with a total capacity of 400 billion cubic meters for regulation of run-off water, were realized. This means that now 75% or 75 million hectares of agricultural land are protected against such destruction. Everyone in China, whether they live in the country or the towns, is supplied with water. In rural areas 50% of the population receive their water from wells, i.e. the water must be fetched from the well and from the stand pipe, but at least it is clean. The other 50% of the rural population are supplied with water by means of a at least it is clean. The other 50% of the rural population are supplied with water by means of a simple pressure water system and have one or two water taps in their houses. In the cities the largest part of the inhabitants are connected to a pressure water supply system. The Water Supply Beijing distributes 95% groundwater and 5% treated surface water. It is just the opposite in Shanghai. The city delivers 5% groundwater and 95% treated river water. In Beijing the water is hard. There are o quality problems only domestic problems with river water. In Beijing the water is hard. There are no quality problems only domestic problems with the calcification. Shanghai, on the other hand, has no domestic problems but quality problems, because the river is being increasingly polluted by waste water. The price of water amounts to 12 Fen or about SFr.0.13 per cubic meter. Compared to the gross national product per inhabitant of Switzerland, a cubic meter of water would cost 35 to 40 ferrors are much or expressed in Switzerland, as who the service of the service services of the service services. zeriand, a cubic meter of water would cost 53 to 40 times as much or, expressed in Swiss Francs about 4.20 to 5.20. Considering the purchasing power then, our ancestors, one hundred years ago, had to pay the same price for water. (Author's abstract) W85-01995

BACTERIA IN WORKS AND MAINS FROM GROUND WATER SUPPLIES,

Aarhus Univ. (Denmark). Inst. of Hygiene. G. J. Bonde

Aqua, Vol. 5, p 237-239, 1983. 1 Fig, 7 Tab, 7 Ref.

Descriptors: *Bacteria, *Water quality control, *Groundwater, *Water distribution, Microorga-

Many changes taking place in the numbers of microorganisms found in water between the works and the consumer premises are investigated. Tests are outlined to identify these organisms, and growths at different temperatures are recorded. These bacteria can spoil food, cause offensive taste and odor problems or give rise to discolored water. A total of 268 samples were examined: 118 from waterworks plants, 150 from mains. The counts at 30 degrees C show a rather uniform counts at 30 degrees C show a rather uniform distribution as to magnitude in mains and works, although there is a tendency to slightly higher counts from the works. Counts at 21 and 37 degrees C, however, show more distinct differences. The counts obtained at these temperatures show a bimodal distribution, which supports theories of pollution and regrowth of different types of organisms. In distribution systems in tall buildings quite high temperatures may be attained during stagnation as over the weekends. Satisfactory supplies deteriorated in 46% of the hospital samples. In temperate water systems high counts of 10,000-50,000 per ml were found regularly and occasionally in ordinary supplies. (Baker-IVI)

FIRST EXPERIENCES WITH A WOMEN-SPE-CIFIC PROJECT FOR THE WATER DECADE,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

Aqua, No. 6, p 275-276, 1983. 3 Ref.

Descriptors: *Developing countries, *Water treatment, *Sudan, Education, Drinking water, Flocculation, Turbidity, Water resources development,

Methods by which turbid waters may be used and cleaned using naturally occurring coagulation materials are described. Efforts are underway to train the local women in rural Africa (Northern Sudan) to make use of these methods in supplying their families with an adequate and clean water supply using water from rivers, irrigation canals, rain ponds, and artificial rain water storage basins. One method makes use of a simple village jar test. The response of different types of rural women to this clarification project is described. (Baker-IVI) W85-02004

REMOTE MONITORING AND OPTIMISA-TION OF PUMPING AT THE SYNDICAT DES EAUX OF LA HAUTE-LOUE (TELESURVEIL-LANCE ET OPTIMISATION DU POMPAGE DU SYNDICAT DES EAUX DE LA HAUTE-LOUES. LOUE), P. Musquere, M. Dumontel, M. Bouverot, and B.

Aqua, No. 6, p 279-284, 1983. 8 Fig.

Descriptors *Drinking water, *Water treatment, *Water distribution, Computers, Economic aspects, Rural areas.

For a long period of time the automation of treatment of drinking water has been limited to large networks because the magnitude of the problems justified the use of data processing to find the solutions. With recent innovations it is possible that these techniques may soon be applied to medium sized rural networks at a reasonable cost. Remote monitoring and automatic control systems, simple but effective, can solve many problems and improve the service offered. Specific use of these modern techniques to solve problems at the Company Gaz et Eaux which is a subsidiary of the Lyonnaise des Eaux is cited as an example. The results of the experimental efforts conducted at this location appear to be promising. (Baker-IVI)

AUTOMATED SENSOR SYSTEMS FOR WATER RESOURCE POLLUTION WARNING AND TREATMENT PROCESS CONTROL, Sunderland and South Shields Water Co. (England)

J. F. Wallwork, and G. Ellison. Aqua, No. 6, p 313-320, 1983. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Monitoring, *Automation, *Water pollution, *England, Water treatment, Sensors, Rivers, Intakes.

Definition is given for an automated sensor system and its functional requirements are stated in relation to pollution warning and treatment process control. The choice of individual parameters to be continuously monitored is described for a river monitoring station which is charged with protections of the process of th monitoring station which is charged with protect-ing a direct river abstraction water treatment works in North East England. Five years of oper-ational experience of the station is reviewed with information given on improvements carried out at the station during that time period. General criteria are offered for automated sensor systems and areas where development of such systems are needed. (Baker-IV) W85-02010

REVIEW OF THE WATER SUPPLY IN THE SOVIET UNION, Zurich Water Supply (Switzerland). M. Schalekamp. Aqua, No. 1, p 9-16, 1984. 24 Fig, 1 Tab.

Descriptors: *USSR, *Water supply, *Drinking water, Groundwater, Water quality standards, Water pollution control, Ozonation, Disinfection.

In terms of land area, the Soviet Union is the largest country in the world. For their drinking

water supplies, the major cities such as Moscow depend almost entirely on surface water. The water supplies of the smallest cities and towns, as well as those in the rural districts, have sufficient groundwater available for their needs. In the Soviet Union 40% groundwater and 60% surface water are distributed. There are quality standards for raw water and for drinking water and laws are in force for the protection of the drinking water in force for the protection of the drinking water common day are required in Moscow, i.e. 5.2 million cu m/day. All the water passes a very intensive treatment system. The largest ozone facility in the world with a capacity of 200 kg ozone/h is situated in the eastern part of Moscow. For water treatment in rural areas simple processes, which are however very effective, are in operation. In the whole country water can be drunk from the tap without any misgivings. Generally speaking, the water supply bodies are of a good standard. (Author's abstract) W85-02012

MATARA WATER SUPPLY PROJECT IN SRI LANKA,

National Water Supply and Drainage Board, Colombo (Sri Lanka).

N. D. Peiris, and J. N. Jones Aqua, No. 1, p 17-25, 1983. 4 Fig, 1 Tab, 2 Ref.

Descriptors: *Water supply development, *Water management, *Sri Lanka, Design criteria, Water demand, Water supply, Developing countries.

Existing problems of a typical water supply operating in a developing country with system capacity well below present demands are delineated. The well below present demands are delineated. The system has a cost recovery system which is inad-equate to finance effective maintenance. There is also a lack of technical skills. The design philoso-phy adopted here has been to keep the supply system basic and straightforward, making best use of gravity for trunk and distribution systems, rationalizing pumping systems, designing treatment systems using minimum simple robust and easy to maintain mechanical and electrical plants and easy to operate with seim-skilled labor. The overall system is capable of extension both eastwards and westwards and there is sufficient capacity to meet the predicted demands for the year 2000. (Baker-IVI) W85-02013

APPROPRIATE TECHNOLOGY TO IMPROVE

DRINKING WATER QUALITY,
Techno-Consult, Karachi (Pakistan).
S. Ahmad, M. T. Wais, and F. Y. R. Agha. Aqua, No. 1, p 26-31, 1984. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Water quality control, *Drinking water, *Water treatment, *Appropriate technology, Turbidity, Sedimentation, Urban areas.

Experimental results indicated that plain sedimentation could be effective as a pretreatment process to reduce the turbidity of raw water to as low as 10 NTU. Plain sedimentation is an appropriate technology to improve the quality of treated water and its aesthetic appearance especially in a developing country where skilled plant operation for the successful control of alum coagulation is absent. Apart from the direct effect of poor quality of the treated water on the community, it has an indirect adverse effect on the water supply system. For urban water management in a developing country, simple technical and technological alternatives should be given due consideration because of numerous factors like educational background, technical skill and surveillance attitude of local plant operators. (Baker-IVI) W85-02014

2001 ... THE FUTURE OF WATER TREAT-MENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),

Compagnie Generale des Eaux, Paris (France). For primary bibliographic entry see Field 6A.

DRINKING WATER IN DEVELOPING COUNTRIES - THE MINIMUM TREATMENT PHILOSOPHY. A CASE STUDY, Norconsult A/S, Sandvika (Norway).

For primary bibliographic entry see Field 3B. W85-02018

OZONATION AND ACTIVATED CARBON FILTRATION: A CRITICAL EVALUATION, J. G. Janssens, F. Van Hoof, and J. Dirickx. Aqua, No. 2, p 102-107, 1984. 6 Fig, 9 Tab, 7 Ref.

Descriptors: *Ozonation, *Activated carbon, *Filtration, Water treatment, Organic carbon, Chlorin-ation, Drinking water.

Ozonation should not be considered as an additional treatment unit process, but rather as an integrated process in the total water treatment system. The value of ozonation should therefore always be assessed as a function of its impact on the other process of which a treatment line is composed. The process of which a treatment line is coimposed. I ne conclusion of the present study can be summarized as follows. Ozonation prior to GAC filtration lengthens the operating time of GAC filters by 60-65%, when using a reduction of 1 mg/1 TOC as a criterion. A dosage higher than 2 mg ozone/1 added shows no additional effect. Additional costs of constitution and the occurred by cost extinger in of ozonation cannot be covered by cost-savings in reactivation of activated carbon. However, when an AOC limit value is applied as a criterion for the an AOC limit value is applied as a criterion for the operating time, ezonation prior to GAC filtration results in a significant shortening of the service time of GAC filters. GAC filters remove the mutagenic activity produced by prechlorination and ozonation until 30 000 bed volumes of water have been treated; in this respect, no difference is found between filters receiving ozonated and non-ozonated waters. (Author's abstract) W85-02019

ULTRAVIOLET DISINFECTION OF WATER, Katadyn Products, Inc., Wallisellen (Switzerland). For primary bibliographic entry see Field 5D. W85-02020

POTENTIAL USE OF ENZYMES AS CATA-LYSTS IN DRINKING WATER FOR THE OXI-DATION OF TASTE CAUSING SUBSTANCES, Societe Lyonnaise des Eaux et de l'Eclairage, Paris (France).

F. Fiessinger, S. W. Maloney, J. Manem, and J. Mallevialle.

Aqua, No. 2, p 116-118, 1984. 3 Tab, 17 Ref.

Descriptors: *Water treatment, *Enzymes, Drinking water, Purification, Bacteria, Horseradish per-oxidase, Taste, Odor, Organic compounds, Chlor-

The efficacy of horseradish peroxidase is considered for the removal of 2-chlorophenol (2-CP), a taste and odor compound, and pentachlorophenol (PCP), a wood preservative sometimes found as a contaminant in drinking water. These compounds were evaluated at low as well as high concentrations, and in the presence of potentially competing compounds. In all experiments, the removal was greater than 95% for 2-CP. The enzyme and percent of the property of the concentrations, were also varied concentrations. oxide concentrations were also varied with no effect on the results. It appears from the study that 100 units/l of horseradish peroxidase and 1 mM peroxide is sufficient for removal of low concentrations of 2-CP. The use of enzymes in drinking water treatment has several advantages over the use of whole bacteria. Enzymes often have high specificities for substrate, so there is better control over the compound removed and the product produced. The enzymes concentration in the water is controlled by the plant operator, thus there is no dependence on the growth rate of the bacteria. Bacteria require an incubation time to acclimatize to the substrate and grow, but enzymes may be added as needs require. (Baker-IVI)

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Water Treatment and Quality Alteration—Group 5F

POTABLE WATER TREATMENT IN TROPI-CAL COUNTRIES: RECENT EXPERIENCES AND SOME TECHNOLOGICAL TRENDS, Societe Degremont, Rueil-Malmaison (France). P. Mouchet.

Aqua, No. 3, p 143-164, 1983. 27 Fig, 13 Tab, 34 Ref.

Descriptors: *Water treatment, *Drinking water, *Tropical regions, Potable water, Water quality, Sedimentation, Filtration, Ozonation, Disinfection,

Recent examples of the treatment of water prob-lems in tropical countries are cited. While these examples are not exhaustive, they are divided into lems in tropical countries are cited. While these examples are not exhaustive, they are divided into groups so as to point out the variety of the problems posed. The examples generally refer to surface waters such as lakes, rivers, and impounded waters, but the treatment of underground water is also referred to where applicable. Treatment problems due to the quality of raw waters such as high turbidities, eutrophication in the impounding reservoirs, entailing in particular the treatment of waters containing very large amounts of algae. Toxics naturally present in the water like arsenic or fluorine, and aggressive waters are examined. Most of these problems are due to the fact that under tropical weather conditions, the differences between the dry season and the rainy season are very pronounced. Waters also vary between very low and very high concentrations of minerals. Technical problems encountered are inherent to the size of the plants, the space available, the search for an optimum efficiency, the origin and variability of the waters. Problems are considered from the points of view of clarification, filtration, and ozonization. (Baker-IVI)

CURRENT WATER TREATMENT PRACTICES IN WESTERN INDIA - CASE STUDIES OF TWO METROPOLITAN CITIES, BOMBAY AND AHMEDABAD,

Tata Consulting Engineers, Bombay (India). A. R. Kanga. Aqua, No. 3, p 173-177, 1984. 2 Fig.

Descriptors: *Water treatment, *India, *Bombay, *Ahmedabad, Planning, Water management, Drinking water, Water resources development, Water supply development.

As cities grow in size and complexity the operational problems of the systems serving them increase both in scale and in complexity necessitating changes requiring the adoption of an integrated approach and the introduction of new simplified patterns. How this is being achieved currently in two of the largest cites in western India. Bombay approach and the introduction of new supparters. How this is being achieved currently in two of the largest cites in western India, Bombay and Ahmedabad, is described with particular reference to the problems of water treatment. The plants as described are larger than any other so far installed in the country. Each city started developing its water supplies on entirely different lines, each commencing with the exploitation of local sources. The overwhelming trend in each case has been a move toward simplicity in order to combat the problems which come with complexity. This drive toward simplicity is visible in the Master Plans for each city. Bombay has had to switch over from gravity supply to one largely dependent Plans for each city. Bombay has had to switch over from gravity supply to one largely dependent on pumping. Ahmedabad will have to phase out the tube wells and bores on which it has been so heavily dependent in the past and switch over the surface supplies. Treatment of water is assuming more importance in each city. The size of treat-ment facilities has also been increasing. These larger plants are vulnerable to situations where the larger plants are vulnerable to situations where the pling up of a back log on washing operations alone can throw the entire plant out of gear. By adopting the system of variable declining rates of filtration such situations involving escalating failures can be much better controlled. In this system when a filter bed gets choked and cannot take its normal burden the load is automatically transferred to other units in the same battery which are in a fresher condition. (Baker-IVI)

COAGULATION AND RESTABILIZATION OF PARTICULATE, MACROMOLECULAR AND

PROTECTED ORGANIC AQUASOLS BY ALU-MINUM (III), Ohio State Univ., Columbus. Dept. of Civil Engi-

neering.
A. J. Rubin, and P. R. Schroeder.
A. J. Rubin, and P. R. Schroeder.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-207364,
Price codes: Ad5 in paper copy, A0 I in microfiche.
Water Resources Center Completion Report No.
711522, March, 1984. 104 p, 20 Fig. 5 Tab, 83 Ref.
Project No. OWRT A-054-OHIO(1).

Descriptors: *Coagulation, *Colloids, *Aluminum III salts, *Chemical coagulation, *Organic soils, Core, Starch, Mineral oil, *Aggregation, *Aluminum compounds, *Water treatment, Hydrogen ion concentration, Hydrolysis.

Chemical coagulation processes for the removal of particulate organic sols including suspensions of finely-ground coal, starch and mineral oil emusions were studied. The specific objectives of the project were to examine the effects of pH, neutral salts and hydrolyzing aluminum salts on the stability of these organic colloids and to determine the mechanisms by which these aggregants operate. Stability imit diagrams were developed for each system. The principal zone of aggregation for those systems using hydrolyzing aluminum salts was the central sweep zone. For both coal and starch, aggregation in the sweep zone was by enmeshment of the colloid in the floc particles of the aluminum hydroxide precipitate. The aggregation of simple mineral oil emulsions by aluminum sulfate was, for the most part, typical of hydrophobic sols.

LACK OF NEPHROTOXICITY IN THE RAT BY SODIUM CHLORITE, A POSSIBLE BY-PRODUCT OF CHLORINE DIOXIDE DISIN-FECTION IN DRINKING WATER, Massachusetts Univ., Amherst. Div. of Public

Fleath.

G. S. Moore, E. J. Calabrese, and A. Forti.

Journal of Environmental Science and Health,

Vol. A19, No. 6, p 643-661, 1984. 2 Tab, 34 Ref.

Descriptors: *Sodium chlorite, *Chlorine dioxide, *Drinking water, *Toxicity, Water treatment, Disinfection, Chlorite ion, Sodium.

This study evaluated the nephrotoxic effects of sodium chlorite when administered in the drinking water of male Sprague-Dawley rats. Sodium chlorite was administered for periods of 30, 90, and Illo days and at concentrations of 31.2, 125, and 500 ppm (along with appropriate negative and positive controls). Examination of sections by light microscope revealed no abnormalities in the kidneys of the rats in the chlorite exposure groups. Water consumption, mortality, kidney weight, body weight change, and percent kidney to body weight ratio showed no statistically significant relationship to chlorite ion concentration, although an association was observed between the latter two paramients. tion was observed between the latter two param-eters and sodium concentration of treatment water. (Author's abstract) W85-02119

DEHALOGENATION OF THREE CHLORIN-ATED HYDROCARBONS: AMINE-ASSISTED VERSUS METAL-CHELATE ASSISTED VERSUS METAL-CHELATE ASSISTED

University of South Florida, Tampa. Chemical and Environmental Management Services Center. K. A. Hewes, and D. F. Martin. Journal of Environmental Science and Health, Vol. A19, No. 6, p 713-724, 1984. 2 Tab, 12 Ref.

Descriptors: *Dehalogenation, *Chlorinated hydrocarbons, Metal chelates, Amines, Chloroform,

Metal chelate compounds of the type M(c-OC6H4CH=NC4H9)2 (M = Ni, Cu, Zn, etc.) participate in the dehalogenation of chloroform in the presence of ethylene diamine or tetramethylenediamine under homogeneous conditions and at elevated temperatures. Both an amine-assisted and a metal-assisted pathway are recognized on the basis of rate expression. In contrast, only an amine-assisted pathway was observed for dichlorometh-

ane. Under non-homogeneous conditions, however, i.e., using pure solvent, dehalogenation led to (M(diamine)n)-Cl2. The importance of solubility as a driving force is considered as are the implications in the design of agents that will effect dehalogenation of chlorinated methanes. (Author's abstract) W85-02121

INSTRUMENTATION CONTROL AND AUTO-MATION FOR ECCUP TREATMENT WORKS. B. E. Marsh.

Water Services, Vol. 88, No. 1060, p 224-224, 228, June, 1984, 2 Fig.

Descriptors: *Water treatment, *Filtration, *Computers, Management, Water treatment facilities, Flocculation, Sedimentation.

Eccup filtration works is an operational water treatment works using flocculation, sedimentation and rapid gravity filtration to treat water supplied to approximately half of Leeds, England. The current output is about 80 l/day. The most recent development is a scheme involving the renewal of filter valves and updating of all the associated control equipment. The major benefits obtained by providing a computer system to integrate the operational aspects of the works are to provide a good opportunity for analyzing the complete process, to demonstrate the technical viability of the system, quantify the practical benefits and define the operating methods and skills required at all levels; and to provide facilities for evaluating and demonstrating the performance of the equipment. The SCADA computer system forms the middle tier of the hierarchical computer system in that it receives plant data from various sources. Special applications of the SCADA software with respect to Eccup are discussed. (Baker-IVI) Eccup filtration works is an operational water

ASSOCIATION OF METAL TOLERANCE WITH MULTIPLE ANTIBIOTIC RESISTANCE OF BACTERIA ISOLATED FROM DRINKING WATER.

Oregon State Univ., Corvallis. Dept. of Microbi-

J. J. Calomiris, J. L. Armstrong, and R. J. Seidler. Applied and Environmental Microbiology, Vol. 27, No. 6, p 1238-1242, June, 1984. 2 Fig, 2 Tab, 26

Descriptors: *Drinking water, *Bacteria, *Antibiotic resistance, *Metal tolerance, *Oregon, Copper, Lead, Zinc, Raw water, Aluminum, Tin, Cadmium, Water distribution.

cterial isolates from the drinking water system of an Oregan coastal community were examined to assess the association of metal tolerance with multiple antibiotic resistance. Positive correlations between tolerance to high levels of Cu(2+), Pb(2+), and Zn(2+) and multiple antibiotic resistance were noted among bacteria from distribution waters but not among bacteria from raw waters. Tolerances to higher levels of Al(3+) and Sn(2+) were demto higher levels of Al(3+) and Sh(2+) were demonstrated more often by raw water isolates which were not typically multiple antibiotic resistant. A similar incidence of tolerance to Cd(2+) was demonstrated by isolates of both water types and was not associated with multiple antibiotic resistance. These results suggest that simultaneous selection phenomena occurred in distribution water for bacteria which exhibited unique natterns of tolerance teria which exhibited unique patterns of tolerance to Cu(2+), Pb(2+), and Zn(2+) and antibiotic resistance. (Author's abstract) W85-02133

DETECTION OF ENTERIC VIRUSES IN TREATED DRINKING WATER, Texas Univ. Medical School at Houston.

B. H. Keswick, C. P. Gerba, H. L. DuPont, and J.

Applied and Environmental Microbiology, Vol. 27, No. 6, p 1290-1294, June, 1984. 5 Tab, 13 Ref.

Descriptors: *Enteroviruses, *Drinking water, Bacteria, Rotaviruses, Turbidity, Raw water,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F-Water Treatment and Quality Alteration

Water treatment, Coliforms, Seasonal variation, Turbidity, Clarification, Filtration, Chlorination.

The occurrence of viruses in conventionally treated drinking water derived from a heavily polluted source was evaluated by collecting and analyzing 38 large-volume (65- to 756-liter) samples of water from a 9 cu m/s (205 x 10 to the 6th gallons (776 x 10 to the 6th liters) per day water treatment plants. 10 to the 6th litera) per day) water treatment plant. Samples of raw, clarified, filtered, and chlorinated finished water were concentrated by using the filter adsorption-elution technique. Of 23 samples filter adsorption-elution technique. Of 23 samples of finished water, 19 (33%) contained viruses. None of the nine finished water samples collected during the dry season contained detectable total coliform bacteria. Seven of nine finished water samples collected during the dry season met turnibidity, total coliform bacteria, and total residual chlorine standards. Of these, four contained virus. During the dry season the personal removale water. During the dry season the percent removals were 25 to 93% for enteric viruses, 89 to 100% for bacteria, and 81% for turbidity. During the rainy season the percent removals were 0 to 43% for enteric viruses, 80 to 96% for bacteria, and 63% for turbidity. None of the 14 finished water samples collected during the rainy season met turbidity standards, and all contained rotaviruses or enteroviruses. (Author's abstract) W85-02136

EFFECT OF CHLORINATION ON ANTIBIOT-IC RESISTANCE PROFILES OF SEWAGE-RE-LATED BACTERIA

Ottawa Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 5D.

EFFECT OF NONCOLIFORMS ON COLIFORM DETECTION IN POTABLE GROUND-WATER: IMPROVED RECOVERY WITH AN ANAEROBIC MEMBRANE FILTER TECH-

Arizona Univ., Tucson. Dept. of Microbiology and

Immunology.
S. G. Franzblau, B. J. Hinnebusch, L. M. Kelley, and N. A. Sinclair.

Applied and Environmental Microbiology, Vol. 48, No. 1, p 142-148, July, 1984. 4 Fig, 6 Tab, 23

Descriptors: *Groundwater, *Potable water, *Coliforms, *Bacterial analysis, *Membrane filter, Most probable number test.

A total of 529 well and distribution potable water samples were analyzed for total coliforms by the most-probable-number and membrane filter (MF) techniques. Standard plate count bacteria and MF noncoliform bacteria were also enumerated. Frequency of coliform detection, turbidity in most-probable-number tubes, and extensive overgrowth by noncoliforms on MF filters were directly proportional to standard plate counts. Recovery of coliforms was greatest by the MF method at low (< 100 CFU/ml) standard plate count densities and better by the most-probable-number method (confirming gas and turbid tube) at high (> 500 CFU/ml) standard plate count densities. In the latter case, overgrowth by noncoliforms on MF filters suppressed sheen development and, in turn, masked coliform detection. Of 341 atypical (no sheen) MF colonies verified by parallel inoculation of lauryl sulfate broth and billiant green-bile broth, 156 were aerogenic in the latter medium. Of atypical isolates, 84% were identified as either Citrobacter or Enterobacter species. A 4.3-fold reduction in numbers of overgrown MF filters and an 2.2-fold increase in numbers of coliforms recovered from 127 water samples was accomplished by anaerobic incubation of the standard MF technique significantly reduced overgrowth and enhanced recovery of coliforms from potable groundwater. recovery of coliforms from potable groundwater. This technique is simple, cost effective, and suitable for monitoring of untreated ground water common to some small water systems and private water sunnies. (A those she free? water supplies. (Author's abstract) W85-02140

5G. Water Quality Control

BEACH FECAL COLIFORMS, Gore and Storrie Ltd., Toronto (Ontario). For primary bibliographic entry see Field 5B. W85-01711

MODELING ALGAL BEHAVIOUR IN THE RIVER THAMES, Institute of Hydrology, Wallingford (England). P. G. Whitehead, and G. M. Hornberger. Water Research, Vol. 18, No. 8, p 945-953, 1984. 7 Fig, 2 Tab, 27 Ref.

Descriptors: *Algal growth, *Thames, *England, *Model studies, Sensitivity analysis, Extended Kalman Filter, Mechanistic models, Forecasting, water, Water quality

Forcasting the movement and growth of algae in river systems is particularly important for operational managers responsible for the distribution and the supply of potable water. Algae affect the taste and smell of water and pose considerable filtration problems at water treatment plants. In a collaborative study with the Thames Water Authority, algal models have been developed for the River Thames. The non-linear process controlling algal growth are examined using a generalized sentitivity analysis technique and the dominant parameters controlling system behavior are identification. rameters controlling system behavior are iden fied. The extended Kalman filter (EKF) is the ned. The extended Kalman filter (EKF) is then used to estimate these important parameters. The technique of using generalized sensitivity analysis prior to EKF estimation is suggested as a pragmatic approach to the problem of identifying the subset of physically, chemically or biologically meaningful parameters controlling system behavior in mechanistic models. (Author's abstract) W85-01720

EVALUATION OF THE VISIBILITY CRITE-RION OF THE MASSACHUSETTS SANITARY CODE FOR SWIMMING IN NATURAL WATERS, Massachusetts Univ., Amherst. Dept. of Civil En-

neering. For primary bibliographic entry see Field 6E. W85-01800

XXVI CFMT - EXHIBITION OF SCIENTIFIC AND TECHNICAL ACHIEVEMENT OF YOUTH IN THE WATER-MANAGEMENT IN-DUSTRY.

Wasserwirtschaft-Wassertechnik, Vol. 34, No. 1, p 9-10, January, 1984.

Descriptors: *Water management, *Water quality, Water treatment, Wastewater treatment, Water pollution control, Drinking water, Water supply.

The 1983 Fair of the Masters of Tomorrow (FMT) demonstrated how the young innovators in this East German movement compare favorably to their older colleagues in the water-management industry in increasing worker productivity, intensifying and rationalizing water facilities and reducing manpower, saving energy and materials, utilizing funds better, and raising quality while reducing costs. In 1983, 33.8% of all youth in the water industry participated in the FMT movement. Of innovators in FMT, 74.3% were young people and 53.8% of youth brigades presented exhibits. At the XXVI Central FMT, 56 exhibits were presented in the environmental-protection and water-management area. These presented a business gain of 1.8 million Marks, a 7.7 million-mark return on investment, savings of 20,441 manhours/yr and 1,789 MWh/yr energy, a 338,231 cu m increase in drinking water in the public network, and a 734,414-cu m savings in circulating water. (Gish-IVI)

RESULTS AND EXPERIENCE OF THE GREIZ WATER-SUPPLY DISTRICT IN THE FIELD OF RATIONAL WATER USE (ERGEBNISSE UND ERFAHRUNGEN DES VERSORGUNGS-

BEREICHS GREIZ BEI DER RATIONELLEN WASSERVERWENDUNG),

For primary bibliographic entry see Field 3D. W85-01880

WASTEWATER PURIFICATION AS RELATED TO THE STUDY OF A RIVER SYSTEM (AB-WASSERREININGUNG IN VERBINDUNG MIT DER UNTERSUCHUNG EINES FLUSSSYS-

DER UNIERSUCHUNG EINES FLUSSSYS-TEMS), Vizgazdalkodasi Tudomanyos Kutato Intezet, Bu-dapest (Hungary). For primary bibliographic entry see Field 5D. W85-01885

QUALITY ASPECTS OF THE BIESBOSCH RESERVOIRS,

Biesbosch Water Storage Corp. (Netherlands). G. Oskam. Aqua, No. 6, p 497-504, 1982. 13 Fig, 7 Tab, 7 Ref.

Descriptors: *Biesbosch Reservoirs, *Netherlands, *Water treatment, *Aeration, *Meuse River, Pretreatment of water, Reservoir operation, Thermal stratification, Ammonia, Chlorination, Heavy metals, Algal growth, Kinetics, Model studies.

The Biesbosch Reservoirs (in The Netherlands) are The Biesbosch Reservoirs (in The Netherlands) are fed with moderately polluted, highly eutrophic water from the River Meuse. Air injection at the bottom of the reservoirs prevents thermal stratification, as this would cause deterioration of water quality. Reservoir mixing also serves as an efficient algal control measure. Under mixed conditions light plays the role of limiting factor for the growth of algae and this, combined with grazing by zooplankton, keeps algal biomass in the reservoirs at low levels. Self-purification process lead to a striking improvement in water quality during the storage period. The improvement not only relates to 'classical' effects like bacterial oxidation of organic substances and ammonia and the die-off of ganic substances and ammonia and the die-off of fecal organisms, but also to removal of inorganic fecal organisms, but also to removal of inorganic and especially organic micropollutants. Physical processes include settling of heavy metals and evaporation of volatile substances, whereas chemical transformations like hydrolysis and photolysis are responsible for the removal of phtalate esters and polynuclear aromatic hydrocarbons respectively. Pollutant behaviour in the reservoirs can be described by kinetic models. This is applied to the control of the ammonia levels in the reservoirs by selective intake of river water. The model uses control of the ammonia levels in the reservoirs by selective intake of river water. The model uses Michaelis Menten kinetics for nitrification of ammonia and also considers the equalizing effect of the reservoirs. As a consequence of the low ammonia concentration in the delivered water breakpoint chlorination is not needed any more and the use of chlorine for transport chlorination has been much reduced. (Author's abstract)

GENERAL STRATEGY FOR SECURITY IN WATER SUPPLY,

Compagnie Generale des Eaux, Paris (France). M. Dutang, and E. Souteyrand. Aqua, No. 4, p 155-159, 1983. 10 Fig.

Descriptors: *Environmental protection, *Water pollution prevention, *Water quality control, *Water supply systems, *Drinking water, *Paris, *France, Accidents, Water pollution control.

Water suppliers can produce top quality drinking water from polluted resources, but are still threatened by accidental pollution. The first stage in the realization of an overall security strategy in the Paris suburbs was to assess the actual risks by inspecting the industrial facilities upstream of the major plants. The second step focused on acquiring knowledge of the behavior of pollution through simulations with rhodamine B and their integration into a computerized mathematical model allowing into a computerized mathematical model allowing for rapid computation of the real impact on plant intakes. The third step, probably the most important, concerned the detection of acute pollution. A highly sophisticated monitoring station upstream ensures enough time to implement safety measures. Two distinct emergency plans have been devised,

Techniques Of Planning-Group 6A

one of which is followed depending on the extent of the pollution. An analysis of the optimum management of the production and back up facilities shows that through the use of alternative resources, interconnections, and increased production prior to arrival of detected pollution, two of the three supply areas are absolutely safe against accidental pollution, and projects to guarantee the third (River Seine) are under study. (Author's abstract) stract) W85-01990

NEW INSTRUMENTATION IN AUTOMATIC WATER QUALITY MONITORING, National Board of Waters, Helsinki (Finland). T. Kohonen, and P. Princz.
Aqua, No. 6, p 292-297, 1983. 7 Fig, 10 Ref.

Descriptors: *Automation, *Water quality control, *Monitoring, Ammonia, Total organic carbon.

*Monitoring, Ammonia, Total organic carbon.

The widespread use of automatic monitoring of water quality is limited both by the lack of suitable sensors and analyzers for continuous measurement and by the expense and the malfunction sensitivity of highly developed and complete monitoring systems. The new Finnish-built automatic water quality monitoring station and the results of the liedletsts made in Finland on the Hungarian ammonia and total organic carbon monitoring equipment are described. The developed water monitoring station is the first type in Finland where the measuring probe is placed directly at the site to be measured. This method avoids the changes in quality of the water due to pumping and transfer of the samples. The system consists of a probe unit including the sensors which is submerged into water, and of the central unit connected to the probe with a multi-core cable. The system has proved to be very reliable for the control of both river water and waste water treatment processes. The use of this station in different measuring circumstances is very easy because of the modular construction. By using simpler measuring means and cheaper monitoring stations together with the newest monitoring instruments, the usefulness of automatic monitoring can be expanded from the measurement of indicative parameters to total quality parameters within the same costs. (Baker-IVI)

AUTOMATED SENSOR SYSTEMS FOR WATER RESOURCE POLLUTION WARNING AND TREATMENT PROCESS CONTROL, Sunderland and South Shields Water Co. (England).

For primary bibliographic entry see Field 5F. W85-02010

ACIDIFIED LAKES: SEDIMENT TREATMENT WITH SODIUM CARBONATE - A REMEDY, Lund Univ. (Sweden). Limnological Inst. G. K. Lindmark. Hydrobiologia, Vol. 92, p 537-547, July, 1982. 10 Fig. 4 Tab, 19 Ref.

Descriptors: *Lake restoration, *Sodium carbonate, *Acidified lakes, Lake sediments, Acidification, Lime, Lye, Phosphorus, Algal growth, Cation exchange, Nutrient transport, Phytoplankton, Hydrogen ion concentration, Lakes.

Until now, additions of lime have been used to restore the buffering capacity of acidified lakes, but an alternative method which is more effective in the treatment of lakes with organogenic sediments has recently been applied in a full-scale experiment. The method, called CONTRACID, is based ment. The method, called CONTRACID, is based on the cation exchange properties of lake sediment. A sodium carbonate (soda ash) solution is injected into the sediment (by a harrow), so that the sediment becomes sodium stocked. A reverse exchange occurs during subsequent acidification. Liming has a limited effect on humic lakes, since Ca-humates have a reduced reverse exchange ability and also the lime, which remains undissolved, is rendered inactive. Ionic exchange processes and nutrient transport were studied in water/sediment cores and in situ enclosures after additions of soda ash, lye- and lime solutions with subsequent re-acidifi-

cation. Sodium carbonate additions in laboratory systems resulted in a sorption to the sediment of 42-62% of the added sodium ions (5 eq/sq m) and a release of 14-78 mg/sq Pm sediment. Similar results were obtained in the enclosures where phosphorus release stimulated algal growth. Sediment pH, elevated by the sodium base addition, was lowered by re-acidification. Limed systems released no phosphorus and only about 25% of the added lime remained active for future neutralization. With the injection of the sodium carbonate solution into the sediment, only about 12% of the added sodium was recovered in lake water by spring circulation. Lake water alkalinity was then 0.12 meq/1 and pH 6-7. Total phosphorus had been raised by 0.007 mg P/l causing an increase in phytoplankton biomas. Observations indicate that manipulations of acidic lake sediment according to the CONTRACID method create a long-lasting neutralizing capacity and a biological stimulation (through phosphorus release), which makes the method an attractive alternative to frequent liming. (Author's abstract)

LAKE TREHORNINGEN RESTORATION PROJECT. CHANGES IN WATER QUALITY AFTER SEDIMENT DREDGING, National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.

Uppsala (Sweden). Water Quanty S.-O. Ryding. S.-O. Ryding. Hydrobiologia, Vol. 92, p 549-558, July, 1982. 5 Fig. 5 Tab, 16 Ref.

Descriptors: *Lake restoration, *Dredging, *Water quality, *Lake Trehorningen, *Sweden, Lake sediments, Macrophytes, Phosphates, Algal growth, Nutrients, Water pollution control, Lakes.

An increased load of domestic wastewater to Lake Trehorningen induced oxygen-poor water conditions and the development of a reduced sulfide-rich sediment layer. Severely polluted, the lake did not recover, even after advanced wasterwater treatment and sewage diversion. Restoration measures with suction dredging and macrophyte elimination were applied in 1975 and 1976. The loose topmost sediment was pumped into an embanked and overwith suction dredging and macrophyte elimination were applied in 1975 and 1976. The loose topmost sediment was pumped into an embanked and overgrown bay which was used as a settling pond. The activities also included a restoration of the shorelines. This project is the largest restoration program carried out in Sweden on a single lake, corresponding to a cost of about US \$2 000 000. The restoration of Lake Trehorningen was followed by a highly intensive research program which included water chemistry and algal assays. The concentrations of phosphate and total phosphorus decreased by 73 and 50% respectively, as summer average values, two years after the restoration. However, the concentrations of phosphorus are still too high to permit this element to act as a prime algal growth-limiting nutrient. The algal biomass has also remained at the same magnitude as before the restoration. Nitrate-N concentrations showed a tenfold increase, based on average values for the summer period. However, based on the results of the algal gassays, a rapid and marked response was obvious, with a drastic decline in the algal growth potential. In addition, the water quality of the tributaries was frequently of an objectionable character (0.1-0.2 g P/cu m). The nutrient loading from these sources exceeds the critical level for the lake, and measures have now been carried out to treat all the inflowing waters for the removal of phosphorus. (Author's abstract)

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

NEW ECOLOGICAL APPROACH TO THE WATER CYCLE: TICKET TO THE FUTURE, Swedish Natural Science Research Council, Stockholm.

Ambio, Vol. 13, No. 3, p 152-160, 1984. 8 Fig, 34 Ref.

Descriptors: *Hydrologic cycle, *Water demand, *Water policy, *Planning, *Human population, Resources management, Water management, Water supply, Water shortage, Water scarcity.

Water availability poses definite limits to popula-tion development in Northern Africa and the Middle East. Projected population growth will not be possible without a fundamental change in ap-proach to the interaction between water and land. be possible without a fundamental change in approach to the interaction between water and land. Ecologists will have to start including the water cycle in the ecosystem concept. As gross demands on water multiply with the population, the 'hunger zone' - a wide belt including both arid and humid areas, centered around the equator - will face critical water shortages by the middle of the next century unless far-reaching management schemes are introduced linking together soil and water conservation. The most damaging impacts will develop in Asia and Africa, where the amount of water available on a per capita basis will be reduced from the present (1980) average level of 5100 and 9000 cu m per person per year, respectively, to 2600 and 1600 cu m per person per year, respectively. Only through more efficient use of water resources can planners even hope to cope with this shortfall. Under conditions of water scarcity it will be necessary to exchange the technical approach to water with a totally new ecologically based approach. (Collier-IVI)

RATIONALIZATION OF CENTRAL PLANNING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALIZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EIN-SATZ DER EDV),

For primary bibliographic entry see Field 7C. W85-01879

PRACTICAL INTRODUCTION OF THE REMOTE CONTROL SYSTEMS AND PROC-ESS CONTROL FACILITIES,

Grombach Consulting Engineers, Zurich (Switzer-

P. Grombach.

Aqua, No. 6, p 285-291, 1983. 6 Fig.

Descriptors: *Remote control, *Water treatment facilities, Monitoring, Computers.

Before rushing into the use of a remote control system, three areas of investigation must be pursued to determine if such a system is necessary. The task of the remote control system or process control facility must be defined as exactly, completely and concretely as possible. Secondly, since the remote control system will generally be introduced into an existing water supply installation which is already controlled in some way, it is necessary to examine in detail the short-comings of the existing monitoring and control system. Thirdly, it is advisable to set a cost limit on the total expenditure for the introduction of the remote control technique and the process control as early as possible. Once these questions are answered, the task must be delineated so that the call for bids can be made. A diagram must be drawn of the whole water supply to be controlled, including all installations. A diagram of the equipment to be installed in the dispatching center must be elaborated. If the scope of supervision and control justifies the installation of a process computer, there are often difficulties in describing the computing program specification. Incoming bids must be evaluated. Preference should be given to the system having the simpler design. (Baker-IVI) The task of the remote control system or process control facility must be defined as exactly, com-

MICRO-ELECTRONICS IN THE WATER IN-DUSTRY - A REVIEW OF PRESENT AND PROBABLE FUTURE DEVELOPMENTS,

Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).

Aqua, No. 6, p 298-301, 1983. 9 Ref.

Field 6-WATER RESOURCES PLANNING

Group 6A-Techniques Of Planning

Descriptors: *Automation, *Water supply, *Management, Computers, Review.

The microprocessor consists of a small central processing unit, complete with an arithmetic unit and memory which can perform logical decisions as required by a list of instructions or programs. Present trends indicate continued development of ication circuits making greater use of opticommunication circuits making greater use of optical fibers, microwave transmissions and, in difficult terrain, satellite links. Program packages are being produced to enable users to write and modify systems without the help of software specialists and new types of language such as PROLOG will enable artificial intelligence to be introduced into systems. PROLOG is a conversational language which allows facts and rules to be stored and questioned and is based on logic rather than numeric analysis. (Baker-IVI) W85-02008

TOWARDS TOTAL AUTOMATION OF WATER DISTRIBUTION (VERS L'AUTOMATISATION INTEGRALE DANS LA DISTRIBUTION

Compagnie Generale des Eaux, Paris (France).

J. Fontaine. Aqua, No. 6, p 302-312, 1983. 11 Fig, 8 Ref.

Descriptors: *Automation, *Water distribution, *Water management, *Paris, *France, Planning, Computers, Remote control, Monitoring.

A brief outline is offered of the initial uses of A brief outline is offered of the initial uses of electronics in water distribution with particular emphasis on centralized remote control. Industrial electronics and data processing as related to the water distribution industry are considered. Recent advancements have enabled systems to be established which provide better operation of installations, improved economic management, proper statistical management which makes possible sound investment decisions. A description is offered of a complete system now under development for fitting out the water supply installations serving 4 ting out the water supply installations serving 4 million inhabitants of the Paris suburbs. Three production plants, on the Seine, Marne and Oise rivers, respectively, delivering an average of 900,000 cu m/day of water, 40 pumping stations and 100 reservoirs spread out over the territory of the 14 communities served have been integrated into the automated monitor and management system. (Baker-IVI) W35-02009

2001 ... THE FUTURE OF WATER TREAT-MENT (2001 ... L'AVENIR DU TRAITEMENT DE L'EAU),

Compagnie Generale des Eaux, Paris (France). P. Schulhof. Aqua, Vol. 1984, No. 2, p 79-85, 1984. 10 Fig.

Descriptors: *Water treatment, Forecasting, Planning, Technology transfer, Data storage and retrieval, Computers, Ozonation, Reverse osmosis.

This research aspires to analyze the lines of force of the current evolution of water treatment technology which has been characterized by a better understanding of the phenomena involved, a mastery of processes, and an increasing complexity of the treatment stages. Integration of processes, use of tertiary reagents, on-line instrumentation, laser, data bank, and computer assisted analysis are some of the technological steps which have characterised the main technical evolution during these last years. Improvements and new developments in ozonation, reverse osmosis, and other treatment processes need to be made before water treatment technology can meet the needs of our immediate future. New methods of measuring water quality have to be widely applied. The great technological revolution in the field of water treatment has not yet occurred but is inevitable. (Wheatley-IVI) This research aspires to analyze the lines of force

CURRENT WATER TREATMENT PRACTICES IN WESTERN INDIA - CASE STUDIES OF TWO METROPOLITAN CITIES, BOMBAY AND AHMEDABAD, Tata Consulting Engineers, Bombay (India). For primary bibliographic entry see Field 5F. W85-02024

CASE FOR AUTOMATED WATER MANAGE-

MENT,
P. Millington.
Water Services, Vol. 88, No. 1060, p 219-220, June,

Descriptors: *Water management, *Automation, *Control systems, *Water distribution, *Water treatment, *Industrial water, *Pumping plants, England, Wales, Remote control, Monitoring.

The water cycle - from reservoir or river to effluent discharge - is under two masters. The water authority controls extraction, storage, delivery and eventually the effluent reception and treatment. In between is the industrialist who manages or mismanages the water distributed for use within his plant. Philip Millington suggests that neither body does this really efficiently and that there is great scope for educated automation to improve reliability and reduce operating costs. (Author's abstract) W85-02130

IRRIGATED AGRICULTURAL EXPANSION PLANNING IN DEVELOPING COUNTRIES: RESILIENT SYSTEM DESIGN,

Cairo Univ., Giza (Egypt). Dept. of Irrigation and

M. N. Allam, and D. H. Marks. Water Resources Research, Vol. 20, No. 7, p 775-784, July, 1984. 5 Fig, 8 Tab, 15 Ref.

Descriptors: *Irrigation, *Agricultural development, *Developing countries, *Planning, Uncertainties, Economic efficiency, Model studies, Resilient system design.

A multicriteria optimization model is built to deter-A mulicriteria optimization model is built to deter-mine performance as well as operating rules of an agricultural system under future uncertainties in-herent in the planning parameters. Performance of the agricultural systems is measured in terms of the economic efficiency and income redistribution cri-taria. The constitute decisions are described. teria. The operating decisions are determined in such a way that the reduction in performance due to unpleasant surprises in the planning parameters can be minimized. The multicriteria model is used can be minimized. The multicriteria model is used in deriving the relationship between the performance of a case study and the unpleasant changes in the planning parameters. A resiliency index in terms of the gradients of these functional relationships in a probabilistic framework is provided. Based on this resiliency index, a definition of resilient system design is reached. (Author's abstract) W85-02144

USE OF MODELS FOR WATER RESOURCES MANAGEMENT, PLANNING, AND POLICY, Office of Technology Assessment, Washington,

DC. R. Friedman, C. Ansell, and S. Diamond. Water Resources Research, Vol. 20, No.7, p 793-802, July, 1984. 1 Fig, 1 Tab, 11 Ref, 2 Append.

Descriptors: *Water management, *Planning *Policy, *Model studies, Mathematical models, In stitutional constraints, Training.

The Office of Technology Assessment (OTA) of the U.S. Congress investigated the current and potential use of water resource-related mathematical models. It focused on mathematical modeling as a means of assessing the broader issue of the nation's ability to analyze and plan courses of action to deal with current and long-range water problems. OTA found that models capable of analyzing many pressing water recovers issues as action to teal with chiral and the problems. OTA found that models capable of analyzing many pressing water resource issues are currently available and that these models have significant potential for increasing the accuracy and effectiveness of information available to manand entectiveness of miormation available to man-agers, decisionmakers and scientists. Surveys and workshops conducted by OTA, however, indicate that institutional constraints to modeling - includ-ing inadequate Federal support services for model dissemination, training, and technical assistance, and maintenance - have impeded modeling from

realizing its full potential. The states, in particular, are hard pressed to fulfill their present responsibilities without an improved capacity to use the best available analytical tools, which they rely on the federal government, in part, to provide. Many major federal agencies, however, lack an integrated plan for developing and supporting models; in the absence of a comprehensive strategy, federal agencies are often unresponsive to both state and federal problem-solving needs. (Author's abstract) W85-02146

6B. Evaluation Process

EVALUATION OF FISHERMAN BENEFITS STEMMING FROM SPECIAL USE FISHERY MANAGEMENT PROGRAMS,

MANAGEMENT PROGRAMS,
Wyoming Water Research Center, Laramie.
M. A. Collins, T. Buchanan, and C. Phillips.
Available from the National Technical Information
Service, Springfield, VA 22161 as PB84-212364,
Price codes: A05 in paper copy, A01 in microfiche.
Completion Report, July, 1981. 97 p., 1 Fig., 17
Tab, 31 Ref, 4 Append. Project No. OWRT B-042WYO(1), Contract/Grant No. 14-34-0001-9161.

Descriptors: *Fish management, *Sport fishing, Recreation demand, *Wyoming, Wild fishery, Trophy fishery.

The major objective of this study was to determine whether waters managed under special wild and trophy management programs were attracting fishermen with interests and preferences consonant with those program objectives. The database for the study was obtained via a combination direct contact and mail questionnaire survey conducted by the Water Resources Research Institute at the University of Wyoming. A total of 1,104 usable by the Water Resources Research Institute at the University of Wyoming. A total of 1,104 usable questionnaires were received from fishermen sampled at four specially managed waters and two control waters. Both the wild and trophy management programs had been recently implemented, but had not been publicized. A program to publicize the specially managed waters was to have been initiated prior to the study, but problems with the program caused the publicity program results of the study generally indicate fishermen with wild or trophy interests were being attracted to the appropriate waters. Based on fisherman preferences (preference domains determined by cluster analysis techniques), the wild fish managed waters were attracting fishermen with wild fish interests, and the trophy fish managed waters were attracting fishermen contacted at the two control (basic yield) waters. The authors feel the results of the study would have shown a stronger relationship between the precibil waters. yieiu) waters. The authors feel the results of the study would have shown a stronger relationship between the specially managed waters and preferences of fishermen using those areas had the planned publicity programs been implemented as scheduled. W85-01831

FISHABLE WATERS EVERYWHERE: AN AP-PROPRIATE GOAL,
Texas Tech Univ., Lubbock. Dept. of Civil Engi-

G. F. Lee, and R. A. Jones. Industrial Water Engineering, Vol. 20, No. 6, p 14-16, 1983. 5 Ref.

Descriptors: *Water quality control, *Legislation, *Navigable waterways, *Industrial discharge, Fish, Channels, Municipal wastes, Wastewater disposal.

Two types of situations in which the goal of fish-Iwo types of situations in which the goal of fishable waters everywhere seems inappropriate are considered. One is industrial channels and the other is domestic or certain other wastewater discharges into natural waters. Industrial channels are typically man made or man enhanced watercourses traditionally considered to be among the most polluted waterways in the world. It is questioned whether state pollution control agencies should now require that all contaminants discharged to these waters be controlled to the degree necessary these waters be controlled to the degree necessary to allow fish and other aquatic life to exist within

Water Demand-Group 6D

them. This was not the intended use and design of these waterways, and there would be some doubt as to the wholesomeness of fish swimming in these waters. With regard to waters in the vicinity of domestic and certain other wastewater discharges, there are two regions of concern: the mixing zone and the zone of potential chronic toxicity. As a public health preventive measure, industrial channels and waters just downstream from municipal and some industrial wastewater discharges should not be made into fishable waters. This can be accomplished by the exclusion of large populations of game fish in these areas which can in turn be done by maintaining low dissolved oxygen in the industrial channels and normal chlorine concentrations in domestic wastewater discharges. (Baker-IVI) IVI) W85-01850

DEVELOPMENT AND FIELD TESTING OF A METHODOLOGY FOR ASSESSING COMMUNITY READINESS FOR SELF-HELP IN THE INSTALLATION, MAINTENANCE AND REPAIR OF WATER SUPPLY AND SANITATION FACILITIES, Water and Sanitation for Health Project, Arlington, VA.

For primary bibliographic entry see Field 7C. W85-01980

WATER DECADE (LA DECENNIE DE L'EAU), Commission of the European Communities, Brussels (Belgium). P. Peligry. Aqua, No. 1, p 27-30, 1983. 2 Tab.

Descriptors: *Water supply development, *Sanitation, *Developing countries, *Financing, *European Economic Community, Rural areas, Rural sociology.

Three major groupings of developing world countries are in need of financial aid from the European Economic Community (EEC) to develop water supply and sewerage systems. These groups include the Africa-Caribbean-Pacific (ACP) countries associated with EEC under the terms of the second Lome Convention, the eight countries situated to the south of the Mediterranean basin each of which has a cooperation agreement with the EEC, and the non-associated countries of the rest of the Mediterranean basin. Latin American and of which has a cooperation agreement with the EEC, and the non-associated countries of the rest of the Mediterranean basin, Latin American and the Middle and Far East who meet certain criteria. The important phases which precede financing include the programming phase which is an agreement between the parties on the amount of aid to be available in a particular period and the sectors of development in which it is to be used, and the examination phase in which the parties jointly evaluate a project according to certain criteria. One problem encountered in the area of water supply development and protection has been that the receiving countries themselves are not giving water sufficient priority in the programming phase through lack of knowledge of the needs. Policies for the water sector are not sufficiently elaborated upon and therefore do not stimulate the development of programs. There has been an acceptance in some countries of EEC participation in village water projects which seems the best chance of improving the conditions of life in rural areas where the population may represent up to 80% of national totals. (Baker-IVI)

ECONOMISING WATER AND FIGHTING AGAINST WASTAGE (ECONOMIE D'EAU ET LUTTE CONTRE LE GASPILLAGE), Lyonnaise des Eaux, Paris (France) F. Auzias.

Aqua, No. 5, p 215-219, 1983. 2 Fig, 8 Ref.

Descriptors: *Water resources development, *Planning, Management, Water management, Water supply, Water demand.

Increasing concentrations of populations and in creasing per capita water consumption have lead to the use of water from resources located at distances further and further away from the area of

need as well as the use of water resources which require treatment and thereby additional expendi-tures of money. Before investigating additional re-sources, efforts should be made to be certain that sources, efforts should be made to be certain that the resources already employed are being used to their best capacity. Different stages of water movement from the catchment to the tap should be reviewed including production, conveyance, and distribution. Behavior of the users must also be investigated. The effectiveness of such actions as these may help prevent the investment of time and money in producing new systems. (Baker-IVI) W85-01996

PLANNING, IMPLEMENTATION OF DIRECTIVES AND PIPELAYING STANDARDS, Service de Eaux, Services Industriels de Geneve (Switzerland).

Aqua, No. 5, p 225-229, 1983. 9 Fig.

Descriptors: *Planning, *Pipelines, *Geneva, Standards, Water mains, Water conveyance, Water distribution, Water demand, Water management.

Planning aspects used in Geneva for the replacement of pipes are detailed. A planned approach is outlined for obtaining information on the condition of the distribution system so that replacement decisions can be made. A review is made of systems in Geneva from before 1950 to the present and developments which have taken place are indicated. The advantages of ductile iron pipes are stressed and practical experience given with some suggestions on the correct method of laying pipes. Ductile iron pipes offer very great resistance to all mechanical stresses to which a water main is often subject. If ductile iron pipes are used the spectacular leakages following burst pipes are no longer possible and serious disturbances to the water supply of the community involved are averted. (Baker-IVI)

MATARA WATER SUPPLY PROJECT IN SRI

LANKA, National Water Supply and Drainage Board, Colombo (Sri Lanka). For primary bibliographic entry see Field 5F. W85-02013

QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT, Kansas State Univ., Manhattan. Dept. of Civil

Water Resources Research Institute, Contribution No. 237, June, 1982. 80 p, 12 Fig. 2 Tab, 16 Ref, 2 Append. Project No. OWRT A-103-KAN(1), Contract/Grant No. 14-34-0001-0118.

Descriptors: *Measuring instream use, *Average annual instream use, *Instream use probabilities, *Instream use, Great Plains, *Kansas.

*Instream use, Great Plains, *Kansas.

The increasing demand for more formal recognition of instream use poses the need for a methodology which appraises instream service in an objective fashion. Little prior effort has been directed toward this goal. This project makes no attempt to assess a dollar value to instream benefits, but does present a procedure for determining an index of the average annual fulfillment of instream use. The suggested procedure requires the joint integration of fulfillment based on velocity and depth considerations with the percent of time the several velocities and depths are encountered. The percent of time analysis utilizes 'use specific' flow duration curves representative of the portion of the year deemed critical to the specified instream use. Case studies for ten different streams and 19 different record periods are presented. In aggregate, these studies cover a wide range of hydrologic regimes encountered in Kansas. Predictive functions developed in the study are useful in predicting the service to instream use for Kansas streams under natural conditions of flow. Computer programs are provided which allow determination of fulfillment indices for either natural or altered flow condi-

tions. The required input data includes the flow duration curve for the critical season, and depth-velocity-discharge relation for the channel reach. W85-02107

6D. Water Demand

WATER SUPPLY IN THE FEDERAL REPUB-LIC OF GERMANY,

Deutscher Verein des Gas- und Wasserfaches e.V., Eschborn (Germany, F.R.).

W. Merkel.

Aqua, No. 6, p 265-271, 1983. 9 Fig.

Descriptors: *Water supply development, *Water quality control, *West Germany, Water resources, Water demand, Water treatment.

The water supply situation of the Federal Republic of Germany is discussed. A balance sheet of resources against demand is outlined together with a description of present and possible future water quality problems. The secular annual average for quality problems. The secular annual average for total water resources is 161 billion cubic meters, comprising 208 billion cubic meters of precipitation, less 129 billion cubic meters of evaporation, plus 82 billion cubic meters in flow from upstream. Roughly one quarter of the resource is used for cooling water for power stations, for industrial uses, and for water supplies to the domestic and small business industry sectors. A description of water treatment techniques used in the Republic is given along with typical examples. The overriding guideline is that of protection of the water supply being favorable to water treatment. The quality of surface water has shown a marked improvement over the past ten years as a result of increased construction of sewage treatment plants. Types of construction of sewage treatment plants. Types of utilities in existence in the country are described along with their powers and responsibilities. Water management is viewed as a public responsibility. (Baker-IVI)

COMPARISION OF WATER CATCHMENT AND STORAGE SYSTEMS IN TWO MICRO-NESIAN ATOLL COMMUNITIES: LAURA AND NAMA,

Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.

MR. A. Stephenson, and H. Kurashina.

Water and Energy Res. Inst. of the Western Pacific, Mangilao, Technical Report No. 50, September, 1983. 80 p, 42 Fig. 6 Tab, 19 Ref. Project No. OWRT A-021-GUAM(1), Contract/Grant No. 13-34-0001-0112, 1112.

Descriptors: *Catchment areas, *Water storage, *Social aspects, *Atolls, Water tanks, Water harvesting, Rural areas, Tropical regions, Rainfall, Marshall Islands, Carolinian Islands, Nama Island,

Majuro Atoll.

This technical report focuses on; a discussion of freshwater catchment and storage systems in Micronesia. Particular attention is paid to the conditions within two small Micronesian atoll environents, the village of Laura on Majuro atoll in the Marshall Islands and the village community of Nama, a small Carolinian island lying outside of Truck lagoon. Both of the study areas lie within American jurisdication in the western Pacific. Fieldwork at Laura in August 1981 revealed that a paradox exists between the abundant availability of freshwater occurring as rainwater and groundwater on the one hand, and frequent shortage of freshwater on the other. Fieldwork on Nama in August 1982 revealed a similar abundant availability of rainwater, but freshwater shortages were rarely reported. It is suggested that different levels of individual initiative and community response to the need for freshwater are apparent in the two island communities being studied. Particular variables such as access to the district center, availability of construction materials and supplies, community level planning and leadership or lack of the same, and time perspectives may be called upon to help explain variations between the freshwater

Field 6-WATER RESOURCES PLANNING

Group 6D-Water Demand

catchment and storage systems found at Laura and W85-02028

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA THROUGH YEAR 2020, Geological Survey, Tallahassee, FL. Water Resources Div.

For primary bibliographic entry see Field 7C. W85-02036

QUANTIFYING THE RELATIVE PERFORM-QUANTIFYING THE RELATIVE PERFORMANCE OF ALTERNATIVE MEASURES FOR FULFILLING INSTREAM USES IN THE PLAINS ENVIRONMENT, Kansas State Univ., Manhattan. Dept. of Civil Engineering. For primary bibliographic entry see Field 6B. W85-02107

MANAGING WATER SCARCITY: AN EVALUA-TION OF INTERREGIONAL TRANSFERS, California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 6F.

6E. Water Law and Institutions

TORT RECOVERY OF ACID RAIN DAMAGES IN THE UNITED STATES - OBSERVATIONS ON PLAINTIFF'S PRIMA FACIE CASE, Vermont Law School, South Royalton. Environ-mental Law Center. D. R. Honabach.
International Journal of Environmental Studies,
Vol. 18, No. 2, p 91-99, 1982. 50 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Damage, *Torts, *Prima facie, Liability, Legal aspects, Decision making, Common law, Air pollu-

An individual acid rain plaintiff in the United States, who would attempt to make a prima facie case in tort to recover damages for harms caused by acid rain must prove that defendant's acid rainoy acar rain muss prove train celemoant a cach rain-making activity was a liability-incurring activity; that defendant's acid rainmaking was the proxi-mate cause of harm; and that plaintiff suffered harms of a type for which damages can be recov-ered. The first two of these problems are the most difficult. Present theories of causation will make it difficult. Present theories of causation will make it difficult for plaintiff to present adequate proof of cause-in-fact because he must pinpoint the source of the harm. Com-on law tort doctrine has long supplied a judicially administered vehicle for dealing with harms suffered by one party as a result of the activities of another. As such, it might be used to address the problem of acid rain. Before tort law may be so used, however, a would-be plaintiff must make out a prima facic case. While traditional applications of tort doctrine might effectively prevent plaintiff from doing so, recent court decisions suggest that plaintiff might nevertheless be successful in obtaining at least partial recovery. (Collier-IVI) IVI) W85-01667

ACID RAIN AND FEDERAL COMMON LAW, Vermont Law School, South Royalton. Environ-mental Law Center.

J. D. Harper.
International Journal of Environmental Studies,
Vol. 18, No. 2, p 101-108, 1982. 32 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Federal common law, Legal aspects, Decision making, Common law, State law, Clean Air Act, Air pollu-

When Illinois v. Milwaukee first came before the Supreme Court in 1972, the court decided, in recognizing the history of federal common law, that federal courts had power to fashion federal common law 'when there is an overriding federal

interest in the need for a uniform rule of decision or where the controversy touches basic interests of federalism' 406 U.S. at 105 N.6. When Illinois v. Miliwaukee finally reached the Supreme Court again in 1981 after a rather lengthy federal court trial and appeal, the majority, on the basis of statutory amendments passed in the interim, decided that federal clean water legislature amendments preempted or displaced federal common law as that body of law could only be developed by the federal courts where congress had not spoken and occupied the field, and where the varying laws of the states required a uniform federally enunciated principle. The Clean Air Act, which is central to the acid rain dilemma also underwent major restructuring in 1977 and it can be comparatively argued that Illinois v. Milwaukee has inescapable precedent value in the acid rain federal common law Clean Air Act context. If so, he federal forum and uniform rule of law that federal common law gave litigants is no longer available. (Author's abstract) interest in the need for a uniform rule of decision stract) W85-01668

LEGAL ASPECTS OF ACIDIC PRECIPITA-

TION, Windsor Univ. (Ontario). Faculty of Law. J. G. W. Manzig, and J. N. Mulvaney. International Journal of Environmental Studies, Vol. 18, No. 2, p 117-127, 1982. 1982. 37 Ref.

Descriptors: *Acid rain, *Judicial decisions, *Legal aspects, *Canadian Clean Air Act, *Canada, Decision making, Common law, Clean Air Act, Emission standards, Air pollution.

Acid rain has been discovered to be a serious problem in Eastern Canada. The legislative competence of the Federal Parliament to deal with air pollution is not well established, but recent cases interpreting the federal general power indicate that the scope of general power has been established. Canadian common law remedies are not likely to be successful, for a variety of reasons. The Canadian Clean Air Act, especially with the 1980 amendments lays the basis for possible adoption of emission standards for acid rain as an international pollutant. Ontario's Environmental Protection Act 1971 may offer a basis for control of emissions political. Ontainto Senvirolimental Protection Act of 1971 may offer a basis for control of emissions resulting in acid rain through regulation of major sources and control orders of medium sized and small sources. One such regulation has already been adopted to apply to the Inco Plant emissions of suffer oxides. (Author's abstract)

INTERNATIONAL COOPERATION AND ACID RAIN POLLUTION: ESTABLISHING THE FRAMEWORK FOR CONTROL.

Vermont Law School, South Royalton. Environ-mental Law Center.

F. X. Cameron. International Journal of Environmental Studies, Vol. 18, No. 2, p 129-134, 1982. 40 Ref.

Descriptors: *Acid rain, *Legal aspects, *Interna-tional cooperation, International law, Air pollu-tion, Decision making, International agreements.

Acid rain pollution is a classic example of a benefi-cial economic activity in one nation producing harmful environmental effects in another nation. narmuti environmental effects in another nation. There has not been a great deal of development in the international legal principles and institutions to address this problem. The international legal principles on State responsibility for environmental damage are still unsettled and substantial procedural and evidentiary obstacles exist to the enforcement of these principles. Regional arrangements that provide a framework for the prevention and control of acid rain offer a promising solution to the problem. An initial step in this regard is the 1979 draft Convention on Long Range Transboun-dary Air Pollution. The convention calls for the dary Air Pollution. The convention calls for the control of air pollution through the exchange of information, research, consultation, and monitoring. The convention is basically concerned with emissions for which it would be difficult to prove damages in any type of judicial or quasi-judicial processing; thus, the emphasis is on prevention. A framework is provided for future action, for more

specific agreements on control technologies, emission levels, and liability. (Collier-IVI) W85-01670

EVALUATION OF THE VISIBILITY CRITE-RION OF THE MASSACHUSETTS SANITARY CODE FOR SWIMMING IN NATURAL WATERS,

Massachusetts Univ., Amherst. Dept. of Civil En-

gineering. R. R. Noss, and K. Hatfield.

R. R. Noss, and K. Hattield. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202530, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center Publication No. 146, April 1983. 35 p, 4 Fig. 2 Tab, 40 Ref. Project No. OWRT A-139-MASS(1), Contract/Grant No. 14-34-0001-2123.

Descriptors: Accidents, Drowning, *Economic justification, *Evaluation, *Institutional constraints, *Safety, *Swimming, Economic evaluation, Liability, Planning, Public access, Recreation, Recreation demand, Recreation facilities, Regulations, Sediment concentration, *Massachusetts, *Standards.

The Massachusetts Environmental Code contains a four-foot visibility requirement for waters designated for primary contact use. This standard may be limiting state, public, and private efforts to expand recreational swimming in the State of Massachusetts. The origins of and the rationale behind the visibility criterion are discerned with an explanation of the motivation for adoption of the requirement. Literature on the factors affecting water safety (including water clarity) is reviewed. However, no quantitative verification of the water safety-water clarity relationship has been presented. Lakes and ponds with and without authorized swimming are compared with regard to their clarity and in terms of the expected percentage failing to meet the visibility criterion. Economic considerations associated with existing and alternative criteria are discussed. The costs connected with any visibility criterion (short of eliminating the existing The Massachusetts Environmental Code contains a visibility criterion (short of eliminating the existing criterion) cannot be justified on the basis of improved water safety alone.

W85-01800

MAJOR INSTITUTIONAL ARRANGEMENTS AFFECTING GROUND WATER IN NEW YORK

Cornell Univ., Ithaca, NY. Dept. of City and Regional Planning. R. S. Booth, and A. Bronson.

K. S. Booth, and A. Bronson. Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202506, Price codes: A07 in paper copy, A01 in microfiche. Center for Environmental Research Completion Report, December 1983. 125 p, 1 Fig. 70 Ref. Project No. OWRT A-097-NY(1), Contract/Grant No. 14-34-0001-2134.

Descriptors: *Groundwater, *Institutional arrangements, *Regulations, *Government policy, Legal authority, *Institutional constraints, *New York, ments, *Regulations authority, *Instit State regulations.

New York State faces a series of problems respecting both the use and quality of its ground water resources. Portions of its population rely extensively on ground water as a source of water supply. The State is heavily populated, has a substantial industrial base, and has a significant agricultural industry. Each of these factors contributes to the growing seriousness of problems in protecting ground water resources for future use. The major institutional arrangements in New York State relating to management of ground water resources are analyzed in terms of use and quality. Part I outlines the objectives and discusses the project's strengths and limitations. Part III provides a brief overview of the nature of ground water resources in New York State, the current use of those resources, and the current concerns about the quality and use of ground water resources. Part III reviews the major, formal institutional/legal arrangements New York State and the federal government have created for managing the quality and use of ground

Ecologic Impact Of Water Development—Group 6G

water. Part IV summarizes the responses to a survey of county and district health offices, and part V summarizes a similar survey of regional offices of NYS Dept. of Environmental Conservation. Part VI lists the interviews conducted. Part VII states the results from the interviews. Part VIII provides an assessment of the information presented. Part IX states a series of major conclusions. W85-01802

STATE LAWS MANDATING WATER CONSERVATION, Maryland Univ., College Park. Dept. of Geogra-

Maryland Univ., College Faix, Sophila States, Sayaran Univ., College Faix, Sophila States, Sayaran Say

Descriptors: *Water conservation, Water supply systems, Leakage, Water loss, *Legal aspects, Water law, *Maryland, State jurisdiction, *State water laws, State regulations.

States have the potential to play a major role in moving water conservation from conferences and reports that identify its advantages to actual practice. The states' regulatory, financial, and educational responsibilities make them especially effective in furthering conservation among public supply systems where various constraints and pressures discourage local initiatives. This research determined the extent and nature of the states' current efforts to further water conservation amorphism. termined the extent and nature of the states' current efforts to further water conservation among these municipal supply systems. Arizona, California, Massachusetts, and New Jersey have multifaceted programs involving conservation plumbing codes, distribution of conservation devices, equipment loan and grant programs to aid leak detection, grants for system rehabilitation and conservation actions, and active information/education outnon actions, and active information cucation our-reach programs for schools, the media, and specific user groups. Approximately 11 other states also have two or more of these programs. The study identified consistent concern for water conservaremained consistent concern for water conserva-tion among water supply planners, but found that state initiatives are severely restricted by a lack of political and financial support. W85-01806

FISHABLE WATERS EVERYWHERE: AN AP-

PROPRIATE GOAL, Texas Tech Univ., Lubbock. Dept. of Civil Engi-For primary bibliographic entry see Field 6B. W85-01850

TASKS OF THE DAM KEEPER (LES TACHES DU GARDIEN DE BARRAGE), Bureau d'Ingenieurs-Conseils, Lausanne (Switzer-For primary bibliographic entry see Field 4A. W85-01859

6F. Nonstructural Alternatives

FLOOD ELEVATIONS FOR THE SOLEDUCK RIVER AT SOL DUC HOT SPRINGS, CLAL-LAM COUNTY, WASHINGTON, Geological Survey, Tacoma, WA. Water Resources Div

For primary bibliographic entry see Field 4A. W85-01773

TRAINING PROGRAMMES IN FEDERAL SYS-TEMS OF GOVERNMENT, National Water Council, London (England).

W. D. Hughes Aqua, No. 3, p 117-119, 1983. 1 Fig.

Descriptors: *Water management, *Training, *Education, *Water supply development, *Gov-

ernment supports, Management, Operation, Developing countries.

oping countries.

In order for developing water systems to be effectively maintained, some degree of training at the local level is necessary. Who is to do the training and who is responsible for seeing that it is carried out are two of the major issues facing water supply development success in various parts of the world. Training, while natural to progress, does not necessarily become naturally organized and therefore the impetus provided by federal or state government is needed to bring control to the scene. A decision must be taken over fundamental issues concerning financing and whether an existing organization or a new one should be specially created and charged with the responsibility for regional if not national training. Managers must be committed to training and need to be helped to understand the significance of maintaining training systems. Analysis of training needs, existing facilities and availability of outside help should be undertaken and a careful assessment made of the most efficient and economic manner in which to progress. A small core of specialist trainers, technically qualified, is of great help to maintain impetus. Good training results from a blend of national effort, local effort and the cooperation of the education service. (Baker-IVI) cation service. (Baker-IVI) W85-01989

MANAGING WATER SCARCITY: AN EVALUA-TION OF INTERREGIONAL TRANSFERS, California Univ., Riverside. Dept. of Soil and En-vironmental Sciences.

Water Resources Research, Vol. 20, No. 7, p 785-792, July, 1984. 1 Fig, 5 Tab, 25 Ref.

Descriptors: *Interbasin transfers, *California, *Water management, Water supply, Water demand, Groundwater recession, Model studies, Economic aspects, Water rights, Market economy.

An interregional trade model is developed for as-sessing the potential of limited market institutions to alleviate water scarcity. The model differs from those of Takayama and Judge, since curvilinear demand functions are employed and an unequal number of supply and demand regions are speci-fied. The model is applied to California using re-gional supply and demand functions estimated for 1980, 1995, and 2020. The results show that water transfers can be substituted for new supplies to 1980, 1995, and 2020. The results show that water transfers can be substituted for new supplies to the extent that less than 100,000 ac ft (123000000 cu m) of new capacity could be justified by 2020. The net benefits to buyers and sellers total \$66 million for 1980 and rise to \$219 million by 2020. The work also demonstrates that trade would lead to premature drawdown of groundwater resources in the absence of management, and might create access absence of management and might create excess supply capacity for urban regions. (Author's abstract) W85-02145

6G. Ecologic Impact Of Water Development

SOME ECOLOGICAL CONSEQUENCES OF A PROJECTED DEEP RESERVOIR IN THE KABALEBO RIVER IN SURINAME, Waterloopkundig Lab, Delft (Netherlands). J. A. Van Pagee, S. Groot, R. Klomp, and J. H. G. Verhagen. Hydrobiological Bulletin, Vol. 16, No. 2-3, p 241-254, December, 1982. 8 Fig. 13 Ref.

Descriptors: *Water resources development, *En-vironmental effects, *Reservoirs, *Devis Reser-voir, *Kabalebo River, *Surinam, Water quality control, Rain forests, Oxygen, Mathematical

An overview is offered of some water quality aspects related to the construction and operation of the projected Devis Reservoir in the Kabalebo River. The construction of a deep reservoir for hydropower generation and the consequent inundation of a tropical rain forest will drastically disturb the ecological equilibrium in the Kabalebo

River basin. Mathematical modelling techniques are used to predict the water quality in the new Devis Reservoir and the adjacent downstream river. Special attention is given to the oxygen budget as the most critical factor in water quality during the first decennium after the start of filling. In order to minimize the ecological impacts of the reservoir construction, an alternative intake design and a delayed filling period are the most promising remedial measures. (Baker-IVI) W85-01764

CHANGES IN THE FISH FAUNA OF THE FORMER GREVELINGEN ESTUARY, BEFORE AND AFTER THE CLOSURE IN 1971, G. Doornbos.

Hydrobiological Bulletin, Vol. 16, No. 2, p 279-283, December, 1982. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Water resources development, *En-vironmental effects, *Grevelingen Estuary, *Neth-erlands, *Fish, Aquatic life, Delta plan, Species diversity, Food chains.

Within the scope of the Delta Plan, a number of estuaries in southwestern Netherlands has been closed off. Subsequent changes in the fish fauna in the Grevelingen Estuary are studied. After the closure in 1971 the number of fish species caught declined from 31 to 18, a number which then stabilized by 1978 at 20. When the connection with the North Sea had been reserved for overs a whole stabilized by 1978 at 20. When the connection with the North Sea had been renewed for over a whole year, the number of species increased to 26. Before 1971 the Shannon-Weaver index was high, declining in 1972 after the damming was complete. After the closure, the number of small pelagic fish increased enormously. Not only have the number of species and the number of individuals changed over the course of time, but the biomass ratios of the demersal species have also changed. The composition of the fish fauna has drastically changed from larger to smaller species, the diversity has decreased and food chains have become shorter. (Baker-IVI) W85-01765

BREEDING MALLARD (ANAS PLATYRHYN-CHOS) HABITAT SUITABILITY MODEL

Washington State Univ., Pullman. Dept. of Agricultural Economics.

S. C. Matulich, and J. E. Hanson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-202555, Price codes: A05 in paper copy, A01 in microfiche. Washington Water Research Center Report 54, November 1983. 67 p. 23 Fig. 61 Ref. Project No. OWRT B-086-WASH(3), Contract/Grant No. 14-34-0001-9160.

Descriptors: *Habitat suitability index, *Wildlife management, *Mallard, Environmental effects, *Washington, Model studies, Literature reviews, Columbia Basin Irrigation Project.

A habitat suitability index (HSI) model is developed for breeding mallards (Anas platyrhynchos). The HSI model framework follows the Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service. Overall habitat suitability is defined in terms of nesting and broodsuitability is defined in terms of nesting and brood-rearing life requisites, and the environmental at-tributes that quantify each cover type's potential for satisfying the breeding season life requisites. A review of literature on breeding mallard habitat requirements is presented, followed by a generic breeding mallard HSI model. This general model is then modified to account for habitat characteristics in the East High area of the Columbia Basin Irriga-tion Project, Washington. W85-01792

TROPHIC ECOLOGY OF FISH REARING

Ohio State Univ., Columbus. Dept. of Zoology. For primary bibliographic entry see Field 2H. W85-01833

Group 6G-Ecologic Impact Of Water Development

TRAVELING SCREENS AS SAMPLING GEAR FOR VERTICAL DISTRIBUTION STUDIES, North Carolina State Univ. at Raleigh. Dept. of

ary bibliographic entry see Field 7B.

MAN-MADE STRUCTURES ON MARINE SEDIMENTS: EFFECTS ON ADJACENT BENTHIC COMMUNITIES,

Scripps Institution of Oceanography, La Jolla, CA N. Davis, G. R. VanBlaricom, and P. K. Dayton. Marine Biology, Vol. 70, No. 3, p 295-303, 1982. 4 Fig. 3 Tab, 34 Ref.

месктирнога: "Benthic environment, "Marine sediments, "Structures, "Environmental effects, "San Diego County, "California, Scour, Sedimentary structures, Fish, Polychaetes, Benthic fauna, Sea pens, Oil platforms, Pilings, Coastal waters, Particle size. Descriptors: *Benthic environment, *Marine sedi-

This study (1975-1977) examines the effect of man-This study (1975-1977) examines the effect of manmade structures on natural sand bottom communities in shallow water in San Diego County, southern California, USA. While there were shallow
scour effects to 15 m around some artificial reefs,
the reefs had no measurable effect on sand ripple
patterns, grain size, organic carbon or infauna
beyond the scoured areas. Foraging by reef-associated fishes produced profound alterations in the
epifauna populations of the sea pen Stylatula elongata. The sea pen densities were 4 to 10/sq m
before the reefs wer established, but within 5 m
owere eliminated from distances greater than 200 m
around the reefs. On the other hand, densities of were eliminated from distances greater than 200 m around the reefs. On the other hand, densities of the tube-building polychaetes Diopatra spp. seemed to be enhanced in the immediate vicinity of the artificial reef. Oil platforms and bridge pilings seem to have much more profound effects on the nearby sand communities than do the relatively small artificial reefs. In addition to the elimination of sea pens, Diopatra spp. densities increased from a the vicinity of oil platforms. Grain size and inflauna were strongly affected by the oil platform. (Author's abstract)

COMMENTARY ON ENVIRONMENTAL IMPACT ASSESSMENT FOR LARGE PROJECTS AFFECTING LAKES AND

STREAMS, British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.

P. A. Larkin. Canadian Journal of Fisheries and Aquatic Sciences, Vol. 41, No. 7, p 1121-1127, 1984. 17 Ref.

Descriptors: *Environmental impact statement, *Lakes, *Streams, Water resources development, Planning, Environmental effects.

Environmental impact assessment is examined as it relates to major projects which will have an influence on aquatic environments in Canada. The purpose of the environmental impact assessment is to guard the public interest in the proper use of resources in the aggregate. Although compromises are usually worked out on a local basis for each project, more widely conceived trade-offs are factored. Executable response to the property of the prope project, more widely conceived trade-ons are in-vored. Frequently environmental impact assess-ments appear to be mere reflections of projects that are going to materialize anyway. It would be pre-ferred if the assessments were to reflect the pattern ferred if the assessments were to reflect the pattern of activity through the various stages of a project from conception, through modification and into the final stages. The need for follow up on projects underway is emphasized. It is also important to anticipate some impacts which may not be easily foreseen as likely, and include possible means for making appropriate financial provisions should these unlikely events actually occur. Assessment of potential impacts should no longer be seen as a substitute for research that would lead to new understandings of ecological systems but rather should be increasing in its contribution to the field of environmental research. (Baker-IVI) W85-01920 CHANGES IN THE NAIAD FAUNA OF THE CUMBERLAND RIVER BELOW LAKE CUMBERLAND IN CENTRAL KENTUCKY,

Army Engineer Waterways Experiment Station, Vicksburg, MS.
A. C. Miller, L. Rhones, and R. Tippit.
Nautilus, Vol. 98, No.3, p 107-110, July, 1984. 2
Fig. 9 Ref.

Descriptors: *Environmental effects, *Water resources development, *Dam effects, *Mussels, *Cumberland River, *Kentucky, Wolf Creek Dam, Clams Mollusks

A survey for live mussels was conducted below Wolf Creek Dam, miles 460.8 to 393.2 on the Cumberland River, Kentucky, in October of 1982 Cumberland River, Kentucky, in October of 1982 to determine if mussel recruitment had taken place following completion of the dam in 1952. Two live mussels were collected, the Spectacle Case and the Purple Pimpleback, found at miles 409.5 and 403.4, respectively. These mussels were lying on, not buried in, the substrate in water that was 50 cm deep or less. The umbones on the latter were deeply eroded and the periostracum on the former were heavily worn, indicating the erosive action of turbulent water in the river. The Asian Clam was the only other live bivalve collected during the study. Turbulent water, fluctuating water levels. study. Turbulent water, fluctuating water levels, and temperatures which remain below 20 degrees C throughout the year are not conducive to mussel recruitment in this area. When the dam was completed, unionid recruitment essentially ceased and existing mussels were gradually lost because of adverse conditions, predation, or natural mortality. (Baker-IVI) W85-01921

LAND USE EFFECTS ON SEDIMENT YIELD

AND QUALITY, British Columbia Univ., Vancouver. Dept. of Geography.

O. Slaymaker. Hydrobiologia Vol. 91, p 93-100, July, 1982. 13 Fig, 4 Tab, 68 Ref.

Descriptors: *Sediment yield, *Water quality, *Land use, Sediment transport, Model studies, Environmental effects

Attempts to establish land use effects on sediment yield and water quality require consideration of background biogeochemical cycling, quantitative land use mapping, selection of appropriate transport and attenuation models, and the assessment of port and attenuation models, and the assessment of critical or threshold amounts and types of land use change. Progress in each of these problem areas is reviewed. Specifics considered include the defining of the nature of the processes and the rates of transformations in the biogeochemical cycle in the absence of land use change; defining land use cate-gories and changes in sufficiently specific and, where possible, quantitative ways so that the re-sulting levels achievable in this measurement are compatible with those of land use excessions are tible with those of land use measurements; define the most appropriate transport and attenuation models which describe the movement of water, sediment, ions, and pollutants through a basin; and defining the criteria by which critical thresholds of land use change can be recognized. (Baker-IVI) W85-02060

7. RESOURCES DATA

7A. Network Design

DATA BANK FOR WATERWORKS AND FA-CILITIES - GOALS AND PROBLEM-SOLVING CONCEPT (DATENBANK WASSERWERKE UND ANLAGEN - AUFGABEN UND LO-SUNGSKONZEPTION),

Institut fuer Wasserwirtschaft, Berlin (German

For primary bibliographic entry see Field 5F.

7B. Data Acquisition

SATELLITE-TRACKED CURRENT DRIFTERS IN LAKE MICHIGAN,

National Oceanic and Atmospheric Administra-tion, Ann Arbor, MI. Great Lakes Environmental Research Lab. R. L. Pickett, J. E. Campbell, A. H. Clites, and R. M. Partridge.

Journal of Great Lakes Research, Vol. 9, No. 1, p 106-108, 1983. 2 Fig. 4 Ref.

Descriptors: *Satellite technology, *Lake Michigan, Water circulation, Remote sensing, Lakes.

Satellite-tracked current drifters were tested for Satellite-tracked current drifters were tested for use in monitoring near-surface currents in Lake Michigan. Each unit consists of a surface float containing the transmitter and batteries, and a 1-m length of line down to a weighted 1 x 4 m parachute. Satellite-determined positions of the drifters were found to be within 0.5 km. Positions were were tound to be within 0.5 km. Positions were obtained every two hr. Four drifters were placed on a transect halfway across southern Lake Michigan and tracked. The median current speed determined from the drifters was 17 cm/s. The path lengths over the first two months ranged from 400 to 700 km. The drifters appear to be ideal for monitoring nearsurface lake currents and testing hydrodynamic lake models. (Moore-IVI) W85-01760

INSTRUMENTATION USED FOR HYDRAU-LIC TESTING OF POTENTIAL WATER-BEAR-ING FORMATIONS AT THE WASTE ISOLA-TION PILOT PLANT SITE IN SOUTHEAST-ERN, NEW MEXICO,

Geological Survey, Albuquerque, NM. Water Resources Div.

J. A. Basler. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-file Report 83-144, 1983. 29 p, 16 Fig. 6 Ref.

Descriptors: *Aquifer tests, *Transmissivity, *Test wells, Data logger, Strip chart recorder, Amplifier, Pressure transmitter, Dead weight tester, Inflatable packers, Barometer bailing test, Waste Isolation Pilot Plant, *New Mexico, Eddy County.

Requirements for testing hydrologic test wells at the proposed Waste Isolation Pilot Plant near Carlsbad, New Mexico, necessitated the use of inflatable formation packers and pressure transduccarisbad, New Mexico, necessitated the use of inflatable formation packers and pressure transducers. Observations during drilling and initial development indicated small formation yields which would require considerable test times by conventional open-casing methods. A pressure-monitoring system was assembled for performance evaluation utilizing commercially available components. Formation pressures were monitored with a downhole strain-gage transducer. An inflatable packer equipped with a 1/4-inch-diameter steel tube extending through the inflation element permitted sensing formation pressures in isolated test zones. Surface components of the monitoring system provided AC transducer excitation, signal conditioning for recording directly in engineering units, and both analog and digital recording. Continuous surface monitoring of formation pressures provided a means of determining test status and projecting completion times during any phase of testing. Maximum portability was afforded by battery operation with all surface components mounted in a small self-contained trailer. (USGS) W85-01827

TRAVELING SCREENS AS SAMPLING GEAR FOR VERTICAL DISTRIBUTION STUDIES,

North Carolina State Univ. at Raleigh. Dept. of

Zoology.

R. A. Rulifson, and B. J. Copeland.

Estuaries, Vol. 5, No. 2, p 82-94, June, 1982. 11

Fig. 9 Ref.

Descriptors: *Traveling screens, *Impingment, *Sampling, *Vertical distribution, Intakes, Diurnal variation, Powerplants, Aquatic life, Screens.

Evaluation, Processing and Publication—Group 7C

A sampling technique has been developed for increasing the information gathered during routine monitoring of impingement at water intake structures. Samples from impingement catches on traveling screens were taken from the sluiceway of the Brunswick Steam Electric Plant near Southport, North Carolina during the screen wash process so sto divide the catch into vertical catch components. Each component represented 1.2 m of the water column. Results showed differences in day and night vertical distributions of impinged organisms according to the spatial preferences of each species. Impingement during daytime was lower than during night. Impingement of surface-oriented species during daytime occurred at mid-depth, midwater species near the bottom, and bottom species were seldom impinged. During the night surface-oriented species were impinged at the surface, midwater species are mid-depth, and bottom species near the bottom. Residue (animals and debris) which remained within the screen wash system from collection of the previous sample, and those organisms which became impinged on the screens during retrieval of the sample, were used to calculate the rate of 'continuous impingement' on the traveling screens. These rates were comparison of these rates indicated that impingement on the timpingement catch in order to determine biases in the vertical catch components. Comparison of these rates indicated that impingement certains becies. This sampling technique for monitoring impingement at intake structures will increase knowledge of the local biologic system while minimizing the cost of obtaining the information. The technique or in problems which may be corrected through modifications to the design of the intake structure. (Author's abstract) W85-01842 intake structure. (Author's abstract) W85-01842

APPLICATION OF REMOTE-SENSING TECH-NIQUES TO HYDROLOGIC STUDIES IN SE-LECTED COAL-MINED AREAS OF SOUTH-EASTERN KANSAS, Geological Survey, Lawrence, KS. Water Re-sources Div.

sources Div.

For primary bibliographic entry see Field 5B. W85-01947

SINGLET OXYGEN IN SURFACE WATERS -PART I: FURFURYL ALCOHOL AS A TRAP-

PING AGENT,
Eidgenoessische Anstalt fuer Wasserversorgung,
Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).

For primary bibliographic entry see Field 2K. W85-01964

SINGLET OXYGEN IN SURFACE WATERS -PART II: QUANTUM YIELDS OF ITS PRO-DUCTION BY SOME NATURAL HUMIC MA-TERIALS AS A FUNCTION OF WAVE-

Eigenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Due-bendorf (Switzerland). For primary bibliographic entry see Field 2K. W85-01965

AUTOMATED WATER LABORATORY -WHAT BENEFIT TO THE CONSUMER, Wessex Water Authority, Bristol (England). Bris-tol Avon Div. J. G. Jones.

Aqua, No. 6, p 321-331, 1983. 12 Fig, 3 Tab, 5 Ref.

Descriptors: *Automation, *Laboratory equipment, *Laboratories, *England, Drinking water, Monitoring, Water quality management,.

For a very long time it has been claimed that the purity of potable water in the United Kingdom is second to none - a very subjective statement, which tends to have been born out by the lack of instances of widespread outbreaks of waterborne disease. In recent years attempts have been made to legislate on the chemical and bacterial quality of both treated drinking waters and the raw waters

from which these were derived through EEC Directives. It has been the long standing practice in the UK to adopt the WHO and European Standards for chemical quality and Report 71 recommendations for both frequency of monitoring and bacterial quality. Much dependence is placed on the sample of water that is taken for analysis, and on the data that the laboratory produces. The scientific implications of the results are again crucial along with any course of remedial action that may be necessary to overcome a deficiency in the sample. In turn these data have to be transmitted to field staff, during working hours - perhaps to change a treatment process or to undertake a flushing operation of the distribution system. It is interesting to reflect on what action can be taken, say on a failed bacteriological sample, outside normal laboratory working hours, bearing in mind that traditional bacteriological samples takes at least 18 hours to produce a result. It has long been the quest of the water scientist to produce the necessary analytical data as quickly as possible in order to minimize the risk of unsatisfactory potable water being passed into the distribution systems. Recent advances in computers and analytical instrumentation have enabled the quest to be brought nearer to reality. This paper outlines the work that has been carried out by Wessex Water in an attempt to achieve that goal. (Author's abstract)

ALTITUDE OF THE TOP OF THE MATAWAN GROUP-MAGOTHY FORMATION, SUFFOLK COUNTRY, LONG ISLAND, NEW YORK, Geological Survey, Albany, NY. Water Resources

R. K. Krulikas, E. J. Koszalka, and T. P. Doriski. USGS Open File Report 83-137, 1983. 1 Map, 1 Fig, 9 Ref.

Descriptors: Areal hydrogeology, *Aquifer systems, Geohydrologic units, *Maps, Magothy aquifer, Suffolk Country, *New York.

The Magothy aquifer, with its irregular surface and deeply eroded buried valleys, has become the major source of fresh water in most of Suffolk Country. With the availability of recent data from deep wells and test holes, refinement of the sur-face-altitude contours has been possible and resulted in substantial revision in some areas. This 1-sheet map delineates the surface altitude of the Magothy aquifer (Matawan Group-Magothy For-mation) and includes a brief text and bibliography. (USGS) W85-02030

EVALUATION OF ELECTRODE METHODS FOR DETERMINING TOTAL RESIDUAL CHLORINE IN VARIOUS WATER MATRICES, Benedict Coll., Columbia, SC. Dept. of Chemistry. J. T. Kinard, F. Jackson, and C. Stackhouse. Journal of Environmental Science and Health, Vol. A19, No. 6, p 735-755, 1984. 7 Tab, 5 Fig. 19

Descriptors: *Electrodes, *Industrial wastewater, *Residual chlorine, Titration, Chlorine, Pollutant identification, Drinking water, Potable water,

Five electrode systems and procedures that are widely marketed for routine determination of total residual chlorine have been evaluated in a variety of water matices. The performance, in terms of accuracy, precision, and sensitivity, has been determined for the Orion 97-70 Residual Chlorine Electrode, Chloritett Monitor, Lazar 136A Chlorine Electrode, the forward amperometric titration method, and the back amperometric titration method, Response times for the former two systems were comparable and ranged for 20-100 seconds for chlorine concentrations ranging from 0.3-7 ppm in all water matrices. The Lazar electrode had considerably longer response times. The Chlortect Monitor and the forward amperometric titration method gave the highest sensitivity with values of plus or minus 0.005 and 0.01 ppm, respectively, at the 1 ppm level. However, the Lazar Electrode could not be completely evaluated be-

cause of inconsistencies in the marketed procedures. (Author's abstract) W85-02123

MICROWAVE MEASUREMENTS OF MOISTURE DISTRIBUTIONS IN THE UPPER SOIL

Arkansas Univ., Fayetteville. Dept. of Agronomy. For primary bibliographic entry see Field 2G. W85-02160

7C. Evaluation, Processing and Publication

EVOLVING DATA PROCESSING ENVIRON-MENT FOR COMPUTATIONAL HYDRAULICS

SYSTEMS, McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics. W. James, and A. Unal. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 187-195, June, 1984. 25 Ref.

Descriptors: *Data processing, *Hydraulics, *Hydrologic data, *Hydrology, Computers, Fortran, Data aquisition, Automation, Meteorology, Fluid mechanics, Model studies, Data base management, Local area networks, Continuous modelling, Time series analysis. series analysis.

Inevitably, distributed data processing will evolve using multi-microcomputer-based data manage-ment systems for civil engineering computational hydraulics and hydrology. Research and developnydraulics and hydrology. Research and develop-ment groups will adopt networked data manage-ment systems including 500K-byte 16-bit and 64K-byte 8-bit microcomputers, FORTRAN as the high level language, and a 60 megabyte central hard disc with boss microcomputer using UNIX-type operating systems. Applications include: data acquisition, management, archiving, and presenta-tion; application programs in areas such as meteor-logy, hydrology, hydrology areas unafter goods! ition; application programs in areas such as meteorology, hydrology, hydraulics, water quality modeling, fluid mechanics, and coastal and ocean engineering; program maintenance and support; documentation and text processing; and real-time control. Hardware and software systems are undergoing rapid development in all these areas. Emerging techniques make it possible to supplant event modelling, and its associated design storm methodology, with more rational continuous modelling, using archived data, statistical processing of output, and graphics input/output. Continuous modelling, however, leads to data management difficulties. Special software for time series management is essential. Sophisticated data base management systems and local area networks permit improved cost performance for concurrent process control and performance for concurrent process control and modelling. Each desk-top computer would be individually assigned hydrological modules, communicating with a central hard disk boss microcomputer. (Collier-IVI)
W85-01709

PREDICTING VARIABILITY IN A LAKE ON-TARIO PHOSPHOROUS MODEL. Michigan State Univ., East Lansing. Dept. of Re-

source Development.
For primary bibliographic entry see Field 2H.
W85-01758

QUALITY-ASSURANCE DATA FOR ROUTINE WATER ANALYSIS IN THE LABORATORIES OF THE U.S. GEOLOGICAL SURVEY FOR WATER-YEAR 1982, Geological Survey, Denver, CO. Water Resources

DIV.

D. B. Peart, and N. A. Thomas.

Available from the OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225. USGS Water-Resources
Investigations Report 83-4264, 1983. 112 p, 180

Fig. 6 Tab, 7 Ref.

Descriptors: Alkalinity, *Chemical analysis, Dissolved solids, Heavy metals, Laboratories, Probability distribution, Quality control, Specific conductivity, Statistics, Trace elements, Trace metals,

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

*Water analysis, *Quality assurance, *Data collec-

The U.S. Geological Survey maintains a quality-assurance program based on the analysis of reference samples for its two water-analysis laboratories located in Atlanta, Georgia, and Denver, Colorado. Reference samples containing inorganic constituents are prepared at the U.S. Geological Survey's Ocala, Florida, office and disguised as routine samples, and sent daily to each laboratory through other U.S. Geological Survey offices. The results are permanently stored in the National Water Data Storage and Retrieval System (WAT-STORE), the U.S. Geological Survey's data base for all water data. These data are analyzed statistically for precision and bias. The results of these statistical analyses are presented for data collected during the 1982 water year. In addition, one sample containing known concentrations of trihalomethanes was analyzed in both laboratories, and these results also are presented. (USGS) these results also are presented. (USGS)

TRUE LOCATION AND ORIENTATION OF FRACTURES LOGGED WITH THE ACOUSTIC TELEVIEWER (INCLUDING PROGRAMS TO CORRECT FRACTURE ORIENTATION), Geological Survey, Denver, CO. Water Resources

For primary bibliographic entry see Field 2F. W85-01780

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIANA SALT-DOME BASIN, PART III, POTENTIOMETRIC LEVELS OF THE WILCOX-CARRIZO AND SPARTA AQUIFERS, Geological Survey, Baton Rouge, LA. Water Resources Division

For primary bibliographic entry see Field 2F. W85-01785

COMPUTER PROGRAM AND DATA LISTING FOR TWO-DIMENSIONAL GROUND-WATER MODEL FOR LARAMIE COUNTY, WYO-

Geological Survey, Cheyenne, WY. Water Resources Div.

M. A. Crist. M. A. Crist. Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4137, 1983. 137 p, 3 Tab, 3 Ref.

Descriptors: *Computer programs, Fortran, Simulation, *Wyoming, Laramie County, *Model studies, Data collections, *Groundwater flow, Hydrologic conditions, *Two-dimensional model.

This is a supplement to the report, 'Effect of pumpage on ground-water levels as modeled in Laramie County, Wyoming,' published as U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1104. The computer program and data used to model ground-water conditions in post-Cretaceous rocks in Laramie County are listed. (USGS)
W85-01787

MACHINE-READABLE DATA FILES FROM THE MADISON LIMESTONE AND NORTH-ERN GREAT PLAINS REGIONAL AQUIFER SYSTEM ANALYSIS PROJECTS, MONTANA, NEBRASKA, NORTH DAKOTA, SOUTH DAKOTA, AND WYOMING, Geological Survey, Denver, CO. Water Resources No.

Div

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4107, 1982. 26 p, 10 Fig. 4 Tab, 11 Ref.

Descriptors: *Water levels, Head data, Basic data, Geologic data, *Hydrologic data, Montana, Ne-braska, North Dakota, South Dakota, Wyoming, Data base, *Northern Great Plains, Madison Lime-

Lists of machine-readable data files were developed for the Madison Limestone and Northern Great Plains Regional Aquifer System Analysis (RASA) projects. They are stored on magnetic tape and available from the U.S. Geological Survey. Record format, file content, and size are given for: (1) Drill-stem-test data for Paleozoic and Mesozoic formation., (2) geologic data from the Madison Limestone project, (3) data sets used in the regional simulation model, (4) head data for the Lower and Upper Cretaceous aquifers, and (3) geologic data for Mesozoic formations of the Northern Great Plains. (USGS)

HYDROLOGY OF LAKE PADGETT, SAXON LAKE, AND ADJACENT AREA, PASCO COUNTY, FLORIDA, Geological Survey, Lakewood, CO. Water Resources Div. S. E. Henderson

USGS WRI/Open-File Report 82-759, 1983. 1 Map Sheet, 12 Fig, 3 Tab, 23 Ref.

Descriptors: *Lakes, *Surface-ground water relationships, Limnology, Dredging, Lake stages, Bathymetry, Aquatic plants, Hydrologic budget, Lake Saxon, Pasco County, Southwest Florida Water Management District, *Floridations*

Development of lakeshore areas and nearby well fields could adversely affect Lake Padgett and Saxon Lake. The hydrology of the lake basins and the effects of present and future ground-water withdrawals were evaluated using available data and computer models developed for other investigations. Parts of both lake bottoms were dredged in 1967 and the lakes were connected by a canal. Dredging was more extensive in Saxon Lake than in Lake Padgett and the maximum depth of Saxon Lake was increased from an estimated 20 feet below mean stage. Lake was increased from an estimated 20 feet below mean stage to 30 feet below mean stage. Water-quality data indicate an increase in specific conductance, alkalinity, and organic nitrogen in Lake Padgett between 1964 and 1980, probably a result of residental development. Both lakes have extensive aquatic plant growth that may impede recreation in some areas. Fecal coliform counts infrequently exceed State criteria for waters used for recreation and for propagation and management of fish and wildlife. Well-field pumping at rates presently allowed will not affect the stage of the lakes. Increased pumping from South Pasco and Cypress Creek well fields would probably cause lake stages to decline by increasing leakage from the lakes to the underlying Floridan aquifer. (USGS) (USGS) W85-01826

RATIONALIZATION OF CENTRAL PLAN-NING IN WATER MANAGEMENT THROUGH THE INTRODUCTION OF EDP (RATIONALI-ZIERUNG DER ZENTRALEN PLANUNG IN DER WASSERWIRTSCHAFT DURCH EIN-SATZ NEW EDW) SATZ DER EDV).

G. Stoye. Wasserwirtschaft-Wassertchnik, Vol. 34, No. 2, p 34-35, February, 1984. 2 Fig.

Descriptors: *Planning, *Water management, *Data processing, *East Germany, Computers, Data acquisition, Data storage and retrieval.

The water-management industry in the German Democratic Republic has been using an electronic data processing (EDP) system capable of generating data to integrate annual plans for individual facilities into the general annual plan for the entire industry. The necessary short analysis time can only be achieved by distributing the lead in the industry. The necessary short analysis time can only be achieved by distributing the load, i.e., by using computer facilities both at individual plants and centrally at the Ministry. A three-dimensional matrix was developed, consisting of data, column, and facility, in which the column entries included the base year, plan price basis 1, plan price basis 1, and government task/obligation (STAG/STAL). Because economic circumstances did not always allow each scale of the column coversement is a data extra column. allow each column corresponding to a data entry to be filled out, some columns (fields) had to be blocked by the computer. Generation of data cor-

responding to various demands of the plan was made possible by changing the matrix. The Unified Planning Project (UPP) used today is an expansion of the matrix designed to reduce the number of error corrections that must be made at the central computer facility by its two-stage nature: data collection, data check, and initial interpretation at the individual facility; integration and interpretation of individual plan data for the entire water industry by a central computer. A KRS 4200 computer is used in both stages with the ALGOL 4200 operating system. STAG/STAL data is collected on machine-readable data carriers and transmitted to the facilities for completion of the project. Integration of investment planning is facilitated by a rigidly programmed three-stage EDP project. (Gish-IVI) W85-01879

THREE-DIMENSIONAL DIGITAL-COMPUTER MODEL OF THE PRINCIPAL GROUND-WATER RESERVOIR OF THE SEVIER DESERT, UTAH,

Geological Survey, Salt Lake City, UT. Water Resources Div.

W. F. Holmes.

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4179, 1983. 123 p, 8 Fig, 3 Tab. 15 Ref.

Descriptors: *Groundwater, *Model studies, Groundwater movement, *Groundwater recharge, *Potentiometric level, Great Basin, *Utah, *Groundwater budget, Sevier Desert.

The principal ground-water reservoir in part of the Sevier Desert, Utah was modeled using a three-dimensional finite-difference model. The model was calibrated by comparing computed and observed water-level measurements in 1952, simulating results of aquifer tests, and simulating ground-water withdrawals during 1952-81 and comparing computed water-level changes during 1952-82 is capable of predicting future water-level changes. The results indicate the model is capable of predicting future water-level changes. The report includes a complete listing of the model data for the 1952-82 simulation. (USGS) W85-01925

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER, NORTHWESTERN MISSISSIPPI, APRIL, 1982,

Geological Survey, Jackson, MS. Water Resources Div.

Available from the OFSS, USGS, Lakewood, CO 80225, Price: \$1.75 in paper copy, \$1.00 in microfiche. USGS Water-Resources Investigations Report 82-4061, 1982. 1 Sheet Map, 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Mississippi, Water resources, *Groundwater, *Maps, *Aquifer, *Water levels, Mississippi River valley, *Alluvial aquifer, Quar-

Water levels were measured in about 500 wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during the period April 12-23, 1982. The water-level change from April 1981 to April 1982, showed a general decline, but the water-level change from September 1981 to April 1982 showed some recovery. Water levels in the Delta were higher along the Mississippi River and Bluff Hills. Historically, water levels decline and rise as the amount of precipitation decreases or increases. Recently, continuous heavy pumping for irrigation has caused general water-level declines in the alluvial aquifer. (USGS)

DISTRIBUTION OF SELECTED CHEMICAL CONSTITUENTS IN WATER FROM THE FLORIDAN AQUIFER, SOUTHWEST FLORI-DA WATER MANAGEMENT DISTRICT,

Geological Survey, Tallahassee, FL. Water Resources Div. M. A. Corral, Jr.

Evaluation, Processing and Publication—Group 7C

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4041, 1983. 1 Map, 4 Fig, 22 Ref.

Descriptors: *Water quality, *Aquifer characteristics, Southwest Florida Water Management District, *Florida, *Maps.

Generalized maps showing variations in concentration of chlorides, sulfates, hardness, and dissolved
solids in the Floridan aquifer have been prepared
as part of a cooperative program with the Southwest Florida Water Management District. This
report covers 10 counties and parts of 6 others
comprising the District. Data used to develop the
report were retrieved from the water-quality files
of the U.S. Geological Survey. Considerable vertical and areal variation of chemical constituents
was found in ground water of the Floridan aquifer.
In general, ground water becomes more mineralized with increasing depth and with increasing
distance from recharge areas due to solution of
minerals from the aquifer. Ground water was also
more mineralized with proximity to the coast, due minerals from the aquifer. Ground water was also more mineralized with proximity to the coast, due to saltwater intrusion. (USGS) W85-01928

DATA FOR GROUND-WATER TEST HOLE NEAR NICOLAUS, CENTRAL VALLEY AQUI-FER PROJECT, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Re-

Sources Div.

J. J. French, R. W. Page, and G. L. Bertoldi.

Available from OFSS, USGS, Box 25425, Fed.

Ctr. Denver, CO 80225. USGS Open-File Report 83-273, September 1983. 60 p, 14 Fig, 10 Tab, 23

Descriptors: *Test hole, *Electrical well logging, Radioactive well logging, Piezometers, *Water-level fluctuations, Water-quality data, Sacramento Valley, Central Valley, *California.

Preliminary data are provided for the third of seven test holes drilled as a part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 NE 1/4 sec. 2, T.12N., R.3E., Sutter County, California, about 1 1/2 miles northwest of the town of Nicolaus. Drilled to a depth of 1,150 feet below land surface, the hole is cased to a depth of 100 feet and equipped with three piezometer tubes to depths of 311, 711, and 1,071 feet. A 5-foot well screen is set in sand at the bottom of each piezometre. Each screened interval has a cement plug above and below it to isolate it from other parts of the aquifer, and the well bore is filled between the plugs with sediment. Thirty-one cores and 34 sideplugs with sediment. Thirty-one cores and 34 side-wall cores were recovered. Laboratory tests were wall cores were recovered. Laboratory tests were made for minerology, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, thermal conductivity, and chemical analysis of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis of the three tapped zones and measured for water level. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS) W85-01929

HYDROLOGIC MAPS OF THE HIGH PLAINS AQUIFER, JANUARY 1981, SOUTHWESTERN KANSAS, Geological Survey, Lawrence, KS. Water Re-

Sources Div.

J. M. Spinazola.

Available from the OFSS, USGS, Lakewood, CO
80225. USGS Water-Resources Investigations
Report 82-4079, 1982. 8 Sheet Maps, 2 Fig, 5 Ref.

Descriptors: *Approximation method, *Hydrologic data, Water distribution (applied), Water management (applied), *Maps, Kriging, Southwest Kansas Groundwater Management District No. 3, *Kansas, *High Plains aquifer.

ematical technique, called kriging, has been used in the form of a computer program to interpo-late hydrologic data based on a network of 562

measured values. The computer program generated estimated values at the center of each 1-mile section in the Southwest Kansas Groundwater Management District No. 3 and facilitated contouring of selected hydrologic data that are needed in the effective management of ground water for irrigation. The kriging technique produced various maps that illustrate hydrologic conditions in the High Plains aquifer, the principal source of water in southwestern Kansas. Maps of the aquifer included the water-table altitudes, which ranged from about 2,040 feet to about 3,580 feet during January 1981, and saturated thickness, which ranged from 0 to over 600 feet during January 1981. (USGS)

TRENDS AND FLUCTUATIONS IN THE PO-TENTIOMETRIC SURFACE OF THE FLORI-DAN AQUIFER, WEST-CENTRAL FLORIDA, 1961-80, Geological Survey, Tallahassee, FL. Water Re-sources Div.

Geological survey, Tainanassee, P.L. Water Resources Div. D. K. Yobbi. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 82-4086, 1983. 1 p, 8 Fig, 1 Tab, 13 Ref.

Descriptors: Potentiometric surface, *Potentiometric flow, Hydrology, Hydrogeology, Floridan aquifer, *Florida.

Trends and fluctuations of water levels in wells tapping the Floridan aquifer in west-central Florida during 1961-80 are described in this report. Water levels in most of the study area have not changed appreciably, except in parts of Hardee, Hillsborough, Manatee, Polk, and Sarasota Councies. In these areas, ground-water pumpage by industry and agriculture caused long-term declines of water levels. The largest declines are centered in the agricultural area of southern Hillsborough and northern Manatee Counties where pumpage lowered water levels more than 30 feet since 1964. Hydrographs of 10 wells show that, during 1976-80, the downward water-level trend discontinued in areas of heavy pumpage and, in areas not affect-80, the downward water-level trend discontinued in areas of heavy pumpage and, in areas not affected by pumping, water levels remained fairly unchanged. Water levels rose more than 20 feet from May 1975 to May 1980 in southwest Polk, Hardee, northeast Sarasota, northeast Manatee, and southwest Hillsborough Counties. In the heavily pumped area of northern Hillsborough County, water levels rose 5 to 10 feet. From September 1975 to September 1980, water levels in southwest Polk County rose more than 10 feet. (USGS) W85-01940

DATA FOR GROUND-WATER TEST HOLE NEAR BUTTE CITY, CENTRAL VALLEY AQ-UIFER PROJECT, CALIFORNIA, Geological Survey, Menlo Park, CA. Water Re-

J. J. French, R. W. Page, G. L. Bertoldi, and R. P.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-697, October, 1983. 54 p, 12 Fig, 10 Tab, 23 Ref.

Descriptors: *Test hole, *Electrical well logging, Radioactive well logging, Piezometers, *Water-level fluctuation, Water-quality data, Sacramento Valley, Central Valley, *California.

This report provides preliminary data for the third of seven test holes drilled as part of the Central Valley Aquifer Project which is part of the National Regional Aquifer Systems Analysis Program. The test hole was drilled in the SW 1/4 NE 1/4 sec. 32, T. 19 N., R. 1 W., Glenn County, California, about one-half mile south of the town of Butte City. Drilled to a depth of 1,432 feet below land surface, the hole is cased to a depth of \$2\$ feet and equipment with these inscrepances tubes \$2\$. 82 feet and equipped with three piezometer tubes to depths of 592 feet, 968 feet, and 1,330 feet. A 5to depths of 392 feet, 498 feet, and 1,330 feet. A 3-foot well screen is at the bottom of each piezome-ter. Each screened interval has a cement plug above and below it to isolate it from other parts of the aquifer, and the well bore is filled between the plugs with sediment. Nine cores and 49 sidewall

cores were recovered. Laboratory tests were made for mineralogy, hydraulic conductivity, porosity, consolidation, grain-size distribution, Atterberg limits, X-ray diffraction, and chemical quality of water. Geophysical and thermal gradient logs were made. The hole is sampled periodically for chemical analysis and measured for water level in the three tapped zones. This report presents methods used to obtain field samples, laboratory procedures, and the data obtained. (USGS) W85-01941

WATER-LEVEL MAPS OF THE ALLUVIAL AQUIFER IN NORTHWESTERN MISSISSIPPI, **APRIL 1983.**

Geological Survey, Jackson, MS. Water Resources

D. M. Sumner.

Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. USGS Water-Resources Investigations Report 83-4285, 1984. 1 Sheet, 4 Fig, 9 Ref.

Descriptors: *Potentiometric level, Aquifers, *Water level, *Alluvial aquifers, Mississippi River valley alluvial aquifer, Quaternary aquifers, *Mississippi River valley alluvial aquifer, Quaternary aquifers, *Mississippi River valley alluvial aq

Water levels were measured in about 500 wells in water levels were measured in about 200 Wells in the Mississippi River valley alluvial aquifer in northwestern Mississippi during April 1983. Ground-water levels have declined in some areas in recent years as a result of heavy irrigation pumpage from this aquifer. Near the areas of prinplantage from this admit. Year the areas to prin-cipal recharge, along the major rivers, and near the Bluff Hills, ground-water levels appear to be rela-tively unaffected by the large aquifer drafts; whereas away from the areas of recharge, in the interior of the basin, ground-water levels have shown a long-term decline. (USGS) W85-01944

MAJOR AQUIFERS IN MINER COUNTY, SOUTH DAKOTA,

Geological Survey, Huron, SD. Water Resources

For primary bibliographic entry see Field 2F. W85-01950

DEVELOPMENT AND FIELD TESTING OF A METHODOLOGY FOR ASSESSING COMM-MUNITY READINESS FOR SELF-HELP IN THE INSTALLATION, MAINTENANCE AND REPAIR OF WATER SUPPLY AND SANITA-TION FACILITIES,

Water and Sanitation for Health Project, Arlington, VA.

R. B. Isely. Aqua, No. 1, p 3-10, 1983. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Community involvement, *Water Descriptors: Community involvement, "Water distribution, "Water treatment, "Wastewater disposal, "Developing countries, "Social aspects, Algorithms, Maintenance, Costs, Public participation, Rural areas, Public health.

A particular gap in the planning capabilities of water and sanitation agencies of developing countries is the ability of field workers to systematically gather and use data on the capabilities of communities to organize efforts to install, maintain and repair water and sanitation facilities. In rural areas, determination of solid particular of solid particular and determination of self-help capabilities of the com-munity to formulate plans and take action often depends on the leadership of trained field workers itarians, public health personnel, agricultural ension workers). A field data-collection instrument and a decision-making algorithm were devel-oped to assist these field workers in selecting optimum modes of intervention in community actions. Development of adequate water supplies, maintenance of water delivery systems, and sewage treat-ment facilities are concerns detailed in plans for rural community involvement. (Wheatley-IVI)

Field 7—RESOURCES DATA

Group 7C-Evaluation, Processing and Publication

GEOHYDROLOGIC DATA FOR TEST WELL USW G-4, YUCCA MOUNTAIN AREA, NYE COUNTY, NEVADA, Geological Survey, Denver, CO. Water Resources

Georgical San Cyper Div. C. B. Bentley.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-063, 1984. 48 p. 21 Fig. 6 Tab, 6 Ref.

Descriptors: *Aquifer tests, *Hydraulic conductivity, *Water-level, *Geophysical logging, *Chemical analyses, *Nevada, Crater Flat Tuff, Yucca Mountain, Nevada Test Site, Nye County.

Data are presented on drilling operations, lithology, borehole geophysics, hydrologic monitoring, core analysis, water chemistry, pumping tests, and packer-injection tests for test well USW G-4. The well is one of a series of test wells drilled in and well is one of a series of test wells drilled in and near the southwestern part of the Nevada Test Site, Nye County, Nevada, in cooperation with the U.S. Department of Energy. These test wells are part of the Nevada Nuclear Waste Storage Investigations to identify suitable sites for underground storage of high-level radioactive wastes. Test well USW G-4 was drilled to a total depth of 915 meters through sudcain; rocks, consisting mostly. meters through volcanic rocks, consisting mostly of ash-flow tuff. Depth of water in the well during of ash-flow tuff. Depth of water in the well during and after drilling and testing ranged from 538 to 544 meters below land surface, at approximate altitude of 728 meters above sea level. Drawdown in the well was about 3 meters after test pumping more than 5,000 minutes at a rate of 16 liters per second. A borehold-flow survey indicated that almost all water withdrawn from the well was contributed by the zone between a depth of about 865 and 915 meters below land surface. Analysis of a composite water sample collected after well completion showed the water to contain 216 milligrams per liter of dissolved solids, with relatively large concentrations of silica, sodium, and bicarbonate. (USGS) bonate. (USGS) W85-02031

DATA FOR GROUND-WATER STUDIES OF THE SAN JUAN BASIN, NEW MEXICO (1982-

Geological Survey, Albany, NY. Water Resources

Div. R. L. Klausing, and G. E. Welder. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-135, 1983. 46 p, 3 Fig, 2 Pl, 5 Tab, 2 Ref.

Descriptors: *Groundwater, Hydrographs, Observation wells, Water quality, *Data collections, vation wells, Water quality, *Data collections, *New Mexico, San Juan Basin, San Juan County,

Ground-water data that can be used for futher hydrologic studies in the San Juan structural basin of New Mexico are reported. Descriptions and a location map of 64 observation wells, a list of iocanon map of e-doservation wells, a list of water levels measured in the observation wells, water-level hydrographs of 32 wells, 15 partial chemical analyses of water samples from wells, and descriptions and a location map of 264 potential observations wells are included. The latter are wells for which good records exist. Their potential for use as observation wells needs to be verified in the field. (USGS) W85-02034

PROJECTED PUBLIC SUPPLY AND RURAL (SELF-SUPPLIED) WATER USE IN FLORIDA

THROUGH YEAR 2020, Geological Survey, Tallahassee, FL. Water Resources Div.

S. D. Leach. Florida Department of Natural Resources (Bureau of Geology) Map Series Number 108, 1984. 1 Map, 4 Fig, 2 Tab, 10 Ref.

Descriptors: *Florida, *Water use, *Public water supply, Rural (self-supplied), Hydrology, *Water supply, *Projection, Florida.

This report portrays Florida's past, present, and future freshwater requirements for public supplies and for rural domestic and livestock self-supplied

use. The combined freshwater use by public supplies and rural domestic and livestock use increased from 225 million gallons per day (Mgal/d) to 1,672 Mgal/d in 1980, and is projected to reach 3,235 Mgal/d by the year 2020. In addition to the stress on the overall freshwater supply resulting from promption grountly average per capita use for stress on the overall freshwater supply resulting from population growth, average per capita use for public supplies and rural use increased from 81 gallons per day (gal/d) in 1950 to 172 gal/d by 1980. This increase in per capita use has been leveling off for the past several years prior to 1980 and is expected to show only a small increase in future years. (USGS) W85-02036

OCCURRENCE, QUALITY, AND USE OF GROUND WATER IN ORCAS, SAN JUAN, LOPEZ, AND SHAW ISLANDS, SAN JUAN COUNTY, WASHINGTON, Geological Survey, Tacoma, WA. Water Re-Geological sources Div.

K. L. Whiteman, D. Molenaar, G. C. Bortleson,

K. L. Whiteman, D. Molenaar, G. C. Bortleson, and J. M. Jacoby. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, USGS Water-Resources Investigations Report 83-4019, 1983. 12 Maps, 19 Fig, 15 Tab, 30 Ref.

Descriptors: *Groundwater, Hydrogeology, *Water quality, *Saline water intrusion, Bacteria, Water use, San Juan County, *Washington, Lopez Island, Orcas Island, San Juan Island, Shaw Island.

Ground water, which supplies most of San Juan County's water needs, occurs in both bedrock and glacial drift. Water in the bedrock occurs in fracglacial drift. Water in the bedrock occurs in fractures in the otherwise dense, poorly permeable rock. Deposits of sand and gravel in the glacial drift provide the best yields to wells drilled into unconsolidated materials. Specific capacities of bedrock wells are typically low, and those of glacial-drift wells considerably higher. Ground water is high in dissolved solids and hardness; 29 of 56 wells sampled had water classified as very hard. Sixteen percent of the 171 ground-water sites tested for indicator bacteria total coliform. fecal one or more of these bacteria: total coliform. fecal tested for indicator bacteria had positive counts of one or more of these bacteria: total coliform, fecal coliform, fecal streptococcus. Nine percent of the 279 wells sampled for chloride in September 1981, appear to be affected by seawater intrusion. All of these wells are located within a mile of the coast; 60 percent of these wells are on Lopez Island. In 1980 an estimated total of 220 million gallons of ground water was withdrawn for all uses. Ninety percent of all ground-water use is for domestic and public supply purposes. Heavy pumpage on north-ern and southern Lopez Island correlates with areas having high chloride concentrations. (USGS) W8S-20045

DRAINAGE BASINS IN DUVAL COUNTY, FLORIDA, Geological Survey, Tallahassee, FL. Water Re-

ources Div.

sources Div.
R. B. Stone, and J. B. Largen.
Available from the OFSS, USGS, Box 25425, Fed.
Ctr. Denver, CO 80225. USGS Water-Resources
Investigations 82-4069, 1983. 1 Map, 1 Fig, 1 Tab.

Descriptors: *Surface drainage, Drainage, *Florida, River systems, *Watersheds (basins), *Drainage systems, Drains, Atlantic coastal plain, Coastal plains, Drainage water, Flood plains, Small watersheds, Tributaries, Lake basins, St. Johns River basin, Nassau River basin, St. Marys River basin, Nassau River basin, St. Marys River basin, Intracoastal waters because the state of th States, Jacksonville.

The drainage basins and subbasins in Duval County, Florida, are delineated on this atlas map. The county's 840 square-mile area is drained by three major river systems; the St. Johns, 668 square miles; Nassau, 113 square miles; and St. Marys, 59 square miles. The remainder of the county is drained by a network of small streams that flow into either the Intracoustal Waterway or directly into the Atlantic Ocean. The sub-basins range in size from less than one square mile to more than 50 square miles. (USGS)

RECHARGE AND DISCHARGE AREAS OF THE FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DIS-TRICT AND VICINITY, FLORIDA,

Geological Survey, Tallahassee, FL. Water Resources Div. G. G. Phelps.

USGS Water-Resources Investigations Report 82-4058, 1984. 1 Map, 4 Fig, 2 Tab, 37 Ref.

Descriptors: *Groundwater recharge, *Groundwater discharge, Water balance, *Florida, Floridan aquifer, St. Johns River Water Management Dis-

The Floridan aquifer is the principal source of most of the freshwater used in the St. Johns River Water Management District. An important step in managing water resources is the delineation of recharge and discharge areas. Geohydrologic factors to be considered when delineating recharge and discharge areas include: altitude and configuration of the potentiametric surface, diseasing and the protentiametric surface, diseasing and the configuration of the potentiametric surface, diseasing and the configuration of the configuration and discharge areas include: altitude and configuration of the potentiometric surface; direction and magnitude of the gradient between the water table and the potentiometric surface; and thickness and permeability of the overlying sediments. Recharge to the aquifer comes almost entirely from rainfall within the Water Management District. Significant recharge occurs where the aquifer is at or very near land surface, and where the overlying sediments are very permeable sand so that recharge takes place downward leakage. Recharge also occurs through sinkholes, sinkhole lakes, and other lakes that have a good connection to the aquifer. Major recharge areas are delineated on the map. Discharge occurs in areas of artesian flow (where the potentiometric surface is above land surface), Discharge occurs in areas of artesian flow (where the potentiometric surface is above land surface), primarily by diffuse upward leakage and by discharge from springs. Fifty-five springs, with total discharge of about 1,600 million gallons per day, are in the Water Management District. Areas of discharge and the location of springs are shown on the map. In 1980, total pumpage in the Water Management District was about 1,000 million gallons per day. Under predevelopment conditions, discharge by springs and upward leakage approximately balanced recharged. Additional discharge by pumpage may or may not be balanced by by pumpage may or may not be balanced by decreased spring discharge of increased downward leakage. Examination of long-term water level trends can indicate if recharge and discharge bal-ance. Graphs of rainfall, water levels, and municipal pumpage for Jacksonville, Orlando, and Day-tona Beach are shown on the map. (USGS) W85-02049

ALTITUDE AND GENERALIZED CONFIGURATION OF THE TOP OF THE FLORIDAN AQUIFER, ST. JOHNS COUNTY, FLORIDA, Geological Survey, Jackson, MS. Water Resources Div.

Div. R. M. Spechler.

Available from OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Water-Resources Investigations Report 83-4101, 1983. 1 Map, 3 Fig, 1 Tab, 9 Ref.

Descriptors: Geology, Stratigraphy, *Aquifers, *Maps, Groundwater, *Floridan aquifer, St. Johns County, *Florida.

The Floridan aquifer is the principal source of freshwater to wells in most of St. Johns County. The aquifer consists of a thick sequence of interbedded limestone and dolomite of Eocene age. The top of the Floridan aquifer, which is irregular throughout St. Johns County, ranges from less than 90 feet below sea level in the extreme southestern part to more than 360 feet below sea level in the northern part, (USGS) the northern part. (USGS) W85-02050

COMPUTATION OF CONTINUOUS STREAM-FLOW RECORDS

Geological Survey, Reston, VA. Water Resources

For primary bibliographic entry see Field 2E. W85_02053

Structures—Group 8A

8. ENGINEERING WORKS

8A. Structures

SEISMIC DESIGN CRITERIA FOR BURIED WATER PIPELINE IN PUERTO RICO, Puerto Rico Univ., Mayaguez. Dept. of Civil Engi-

ruerio Rico Univ., Mayaguez. Dept. of Civil Engineering.

R. Jimenez-Perez.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-212380, Price codes: AQ2 in paper copy, AQ1 in microfiche. Water Resources Research Institute Completion Report, August 1983. 21 p. 9 Fig. 2 Tab, 15 Ref. Project No. OWRIT A-076-PR(1), Contract/Grant No. 14-34-0001-2141

Descriptors: *Pipelines, *Seismic properties, Design criteria, Puerto Rico, Water supply.

The primary objective of this report was to determine the effect of carthquakes on buried pipelines constructed in Puerto Rico. The work established the design earthquake parameters required together with a simplified dynamic analysis technique that considers the effect of the time history variation of the earthquake and of different soil layers along the conduit alignment. The simplified method assumes that the soil mass and the pipeline react to the earthquake ground excitation as a unit and that there are no relative displacements between the soil and the pipeline. The simplified model was used to determine the maximum axial strains for pipelines placed in homogeneous or in different soil masses. The study concluded that the axial strain is smaller for stiffer soils regardless of the pipe length embedded in the soil mass. The axial strains determined from this analysis can be combined with the additional stresses to determine the failure criteria for the pipeline. The primary objective of this report was to deter-

REBUILDING OF THE HYDRO-ELECTRIC POWER STATION OF SPIEZ (KRAFTWERK SPIEZ ERNEUERUNG 1982-1985),

che Kraftwerke A.G. (Switzerland).

Bernische Kr P. Hartmann. , Energie, Luft, Vol. 76, No. 3/4, p 29-30,

Descriptors: *Hydroelectric plants, *Water resources development, *Spiez, *Switzerland, Hydroelectric Plant, Simme River, Kander River, Construction, Turbines, Pipes, Dam construction

The hydroelectric power station of Spiez was built originally in 1899 on the River Kander. In 1908 the station was expanded by adding runoff from the watershed of the River Simme. Currently, rebuildwatershed of the River Simme. Currently, rebuild-ing is again underway, having begun in 1982 and expected to be completed by 1985. Rebuilding will include both the control dams of the Kander and the Simme. The previous four feeding water pipes will be replaced by a single pressure pipe. The former power house is to be replaced with a new power station holding two Francis turbine groups for a power level of 18.2 MW. This will replace the former six rotary current groups and the for a power level of 18.2 MW. This will replace the former six rotary current groups and the former three monophase current groups for rail-way supplies. The rest water left in the River Simme will power a small power station using a head of 15 m. Annual energy production, which had been 74 GWh, will be increased to 93 GWh. (Baker-IVI)

WEINZODL POWER STATION ON THE MUR (DAS KRAFTWERK WEIZODL AN DER MUR), Suiselectra Ingenieurunternehmung A.G., Basel.

er, Energie, Luft, Vol. 76, No. 3/4, p 49-51,

Descriptors: *Weinzodl, *Mur river, *Austria, *Hydroelectric plants, Turbines, Coatings, Turbine buckets, Catchment area, Small head hydropower, Design flow.

The Weinzodl power station is situated on the Mur river in the Steiermark region of Austria. It con-

sists of a machine house with two Straflo turbines (horizontal axle, double regulation, outer-rim generator) on the left bank with an adjoining thresectional weir having a 7.5-m-high baffle plate. A mill canal branches off from the right weir pier; the 2.3-m head thereby created is utilized by a small power station (0.2 MW output, 11 cu m/sec usable water volume, 1 Straflo turbine). The main power station is designed for a maximum reservoir level of 364 m, a head of 10 m, and a design flow of 180 cu m/sec. Design flow is reached or exceeded on 42 days in an average year; mean annual flow is 115 cu m/sec, and flood flow can reach 1,800 cu m/sec. Output of the main power station is 25.0 GWh in the 6-mo winter season and 50.0 GWh in summer at the small power station, it is 1.5 GWh annually. The catchment area comprises 7,000 sq km. The facility is situated in a groundwater-conservation area, which necessitated special studies and procedures. Swiss companies played a significant role in design and construction and supplied the turbines. Of particular interest are the measures for inner conservation of the turbines and the coating of the rust-free stainless-steel turbine buckets at this and other power stations on the Mur. (Gish-IVI) W85-01860

CONSTRUCTION OF THE ALICURA HYDRO-ELECTRIC FACILITY IN ARGENTINA (DER BAU DER WASSERKRAFTANLAGE ALICURA IN ARGENTINIEN), Electrowatt Engineering Services Ltd., Zurich (Switzerland).
H. Busenhart.

er, Energie, Luft, Vol. 76, No. 3/4, p 57-60,

Descriptors: *Hydroelectric plants, *Alicura, *Argentina, *Dam construction, Transmission lines, Earth dams, Outlets, Gates, Intakes, Cofferdams.

The Alicura hydroelectric facility, which is soon to begin operating, is situated on the Limay river in southern Argentina and is the uppermost of a chain of four such facilities. It is designed for an output of 1,000 MW and will produce 2,500 GWh per year. A 500-kV transmitter is under construction that will by 1985 cover the 1,700 km to Buenos Aires. The earth dam is 120 m high with a volume of 13 million; cut mits reservoir canacity is Buenos Aires. The earth dam is 120 m inga with a volume of 13 million cu m; its reservoir capacity is 2.4 billion cu m. At the dam site, the river curves sharply; the bank on the inner side is steep (50% gradient) with a plateau at the top, on which the intake and flood-control facilities are built. One of intake and flood-control facilities are built. One of the two diversion pipes used during construction is now the bottom outlet. The coffer dams were integrated into the body of the main dam. At the intersection of the bottom outlet and grout curtain, two synchronously controlled operating gates and two gates for repair purposes were installed, each 2.4 m wide and 3.0 m high. The power house with its 116-m head and 4.25-0MW Francis turbines lies on the left bank. Its water is channeled from reser-toric to intake facility and via four pressure pines to on the left oats. Is water is channeled from reservoir to intake facility and via four pressure pipes to the power house. Both intakes are below the grout curtain. The distance between intake and power house is thus so short that no water tower is needed; however the disadvantage is that the chan-nel in this area must be carefully sealed and net in this area must be carefully sealed and drained. The entire project lies in an area of sand-stone with layers of clay. Companies from Europe, the USA, and Japan, as well as Argentina (which contributed most of the personnel) participated in the project. Switzerland contributed 6% of the effort but retained 100% of the responsibility. (Gish-IVI) W85-01862

HYDROELECTRIC POWER STATION AT THE NETSTAL LIME FACTORY (DAS WASSERK-RAFTWERK DER KALKFABRIK NETSTAL

AG), Electroplan, Basel (Switzerland). El. Pucher. Wasser, Energie, Luft, Vol. 76, No. 5/6, p 99-102, 1984. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Hydroelectric plants, *Netstal, *Switzerland, Turbines, Trash rakes, Automation, Intakes, Gates, Overflow valves, Hydroelectric power, Generators.

A new hydroelectric power station was designed at the site of an old one at the Nestal lime factory on the Linth river, Switzerland. The object was to expand water-flow utilization while retaining the old weir, intake site, and reservoir capacity. The application of innovative devices (floating beam, steel cantilever still, new type of overflow valve floating-matter transporter, automated control room) can result in an economically viable facility even in unfavorable circumstances. Reservoir capacity remained at 457.35 m, usable water volume was increased from 4.0 to 4.0-20.0 cu m/sec, a horizontal Kaplan-S pipe turbine replaced the old Francis shaft turbine, turbine output rose from 132 to 802 kW, generator output increased from 85-110 kW to 148-660 kW, average output was 530 kW (90 kW at the old facility), and annual energy production was 4.2-4.5 GWh as compared to 0.9-10.5 GWh previously. The inlet facility consists of a rake, its cleaning machine, overflow valve, and scour gate. Floating matter caught in the rake is thrown into a 1-m-wide channel, which can be heated. From here it is driven by a motorized transporter into a trench. This device obviates the necessity for an inclined channel and conserves rinse water; in winter, ice problems are avoided. The automated control room allows the facility to be operated by one man. Power-house construction cost was 5 million Swiss Francs; investment cost excluding headwater channel was 5,350 Francs/kW. (Gish-IVI) W85-01866 even in unfavorable circumstances. Reservoir ca-pacity remained at 457.35 m, usable water volume W85-01866

PROGRESS IN ROCKFILL DAMS

Cooke (J. Barry), Inc., San Rafael, CA. J. B. Cooke.

Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1383-1414, October, 1984. 10 Fig, 2 Tab,

Descriptors: *Dam construction, *Rockfill dams, *Reviews, Embankments, Design criteria, Construction, Performance evaluation.

The contributions of Karl Terzaghi, a major contributor to progress in embankment dams, are noted and a history of parallel development of earth core and concrete-face rockfill dams is preand a misory of paramet development of the compacted along with an analysis of the impact of compacted rockfill on the concrete face rockfill dams. Figure 1830 to 1940 stressed mainly the construction of dumped rockfill dams. The transition period from 1850 to 1940 stressed mainly the construction of dumped rockfill dams. The transition period from 1940-1965 saw developments in the area of engineered rockfill dams. The modern period from 1965 to 1982 has enjoyed widespread use of compacted rockfill dams of earth core and concrete face type. Recent progress in the design and construction of this type of dam is outlined. Design trends and performance data are reviewed. Specific areas of concern include the use of water in compacted rockfill, rock quality, use of gravel, modern earth core compacting techniques, modern concrete face rockfill dam construction, cold weather sites, seismic resistance of compacted. weather sites, seismic resistance of compacted rockfill, pumped storage cyclic operation, toe slab foundations, stability, upstream face rockfill, face slab placement, construction scheduling, river handling, and rockfill placement. (Baker-IVI)

SHEETPILE INTERLOCK TENSION IN CEL-LULAR COFFERDAMS,

Southern Illinois Univ. at Edwardsville. Dept. of Civil Engineeringl M. P. Rossow.

Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1446-1458, October, 1984. 13 Fig, 10 Ref.

Descriptors: *Cofferdams, *Construction, *Tension, *Sheetpile interlock tension, Design criteria, Dams, Analytical methods, Mathematical equa-

An analytical method is presented for the calcula-tion of the interlock tension in the sheetpile walls of a cellular cofferdam. The method is based on the assumption that the walls act as inextensible membranes offering no esistance to bending about

Field 8—ENGINEERING WORKS

Group 8A—Structures

a vertical axis. A set of governing equations has been derived by stating the condition of equilibri-um and compatibility. Examination of the calcula-tions for an example problem reveals that the method provides theoretical backing for Swaket's tions for an example problem reveals that the method provides theoretical backing for Swaket's equation for the force in the common wall (Swatek, E.P., Cellular Structure Design and Installation, Proceedings of the Conference on Design and Installation of Pile Foundations and Cellular Structures, Envo Publishing Co., Inc. Pennsylvania, 1970, pp. 413-423.). The calculations also suggest how Swatek's equation may be generalized to allow the value of the fill pressure in the arc-cell to differ from that in the main-cell. The calculations in the example also confirm the previously observed importance of the rotation of the Y connection in carrying the loads. Although the method has been presented here for the particular sheetpile wall configuration corresponding to a circular cofferdam, the basin approach also applies to other sheetpile structures. Since the method's predictions of interlock forces depend crucially on the specification of the fill pressure acting on a wall, the confidence to be placed in the predictions is directly related to the confidence with which a single number can be used to represent the complex soil-structure interaction which occurs in a flexible earth-retaining structure. (Baker-IVI)

MICROCOMPUTER PROGRAMS FOR DE-

MICROCOMPIDER PROGRAMS
SIGNING WATER SYSTEMS,
Public Works Dept. of Malaysia, Kuantan.
E. S. Koh, and D. R. Maidment.
Journal of the American Water Works Association, Vol. 76, No. 7, p 62-65, July, 1984. 1 Fig. 2

ors: *Computers, *Design, *Water distri-Developing countries. Water demand. bution, Developing countries, Water demand, Water supply, Pumps, Pipelines, Storage reser-

The use of microcomputers can help engineers and planners in designing water supply systems, especially for developing countries. Five programs written for microcomputers (DEMAND, YIELD, MAINS, RESERV, AND COSTS) deal with a sequence of problems in the design of a water supply system: projecting demand, determining the yield of a water source, calculating pump and pipeline capacities, sizing a storage reservoir at the location of demand, and performing an economic analysis of alternative designs. (Moore-IVI) W85-01903

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES,

Aqua, No. 4, p 161-167, 1983. 12 Fig, 17 Ref.

Descriptors: *Pipelines, *Pipes, *Corrosion control, *Protection, Cathodes, Coatings, Conveyance structures, Water transport, Water mains, Developing countries, Soil resistivity, Cathodic protections.

For effective protection against corrosion of cast iron and steel water pipelines in developing countries - where soils are often highly corrosive - the use of high-grade coating materials and cathodic protection, as well as regular maintenance, is vital. In soils of low resistivity the annual rate of corrosion may be as high as 1 mm. Pipes are coated by bituminous or plastic material to isolate the metal from the soil. The impact strength and the compressive strength of the coating material and coating application in accordance with standards and specifications are vital for effective protection. Measures taken to protect the inner surface of water pipelines from corrosion and encrustation include grout lining. For effective cathodic protection at acceptable cost, pipelines must be conductive, they must be isolated from grounded pipeline components, and the resistivity of the coating material used must be sufficiently high. Pipelines may be protected cathodically by impressed current systems or by sacrificial anode systems. If power supply or sparse pose a problem, the use of galvanic anodes in low-resistivity soils may be a reasonable option. Like other plants and installations, ca-

thodic protection systems must be monitored and maintained. Cathodic protection engineers, who may be company trained or trained at specialized institutions are needed for the operation of cathod-ic protection systems. In many applications, effec-tive and economic protection is achieved by com-bining pipeline coating and cathodic protection. (Collier-IVI) W85-01991 785-01991

COMPARISON OF WATER MAINS CLEAN-ING TECHNIQUES - THE EXPERIMENT OF BEGLES (COMPARAISON DES TECHNIQUES DE CURAGE DES CONDUITES D'EAU POTA-BLE - L'EXPERIENCE DE BEGLES).

Lyonnaise des Eaux, Bordeaux (France).

J. Petry, and Ph. de La Clergerie.

Aqua, No. 5, p 231-233, 1983. 6 Fig.

Descriptors: *Pipelines, *Cleaning, *Water mains, Water conveyance, Water distribution.

The practice of replacing water pipes is not only expensive, but it also causes great inconvenience for those relying on the use of those pipes. Costs of iron, excavating, road repairing and manpower have all increased over the past few years. Managers of water supply systems are compelled to clean pipes, if possible, rather than to replace them. The three methods of soft scrapers, rods, and metal scrapers were used to clean various heavily encrusted pipes in the district of Begles, part of the Urban Community of Bordeaux. A comparison of the effectiveness of these three methods is offered. W85-01999

WORLD'S LONGEST TUNNEL, Helsinki Metropolitan Area Water Co. (Finland). Aqua, No. 6, p 272-274, 1983. 2 Fig.

Descriptors: *Tunneling, *Helsinki, *Finland, Lake Paijanne, Construction, Water distribution, Water supply, Water conveyance.

The Paijanne Tunnel was constructed in Finland to transport water and to ensure the supply to Helsinki for many years in the future. The tunnel is Helsinki for many years in the future. The tunnel is 120 km long through solid rock from Lake Paijanne to the outskirts of the city. Removal of half a million lorry loads (10 cu m) of rubble was necessary for the tunnel to be built. Quarrying activities alone occupied one and a half million manhours and 40,000 blasting operations. The cost was in US dollars, 113 million. Work was begun in 1973 and completed in 1982. The work, when completed, produced the world's longest continuous rock tunnel. (Baker-IVI) W85-02003

8B. Hydraulics

MODELLING CRITERIA FOR BUBBLE PLUMES - A THEORETICAL APPROACH, National Water Research Inst., Burlington (Ontar-

G. Tsang. Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 293-298, June, 1984. 1 Fig. 9 Ref.

Descriptors: *Bubble plumes, *Model studies, Bubbles, Plumes, Buoyancy, Gases, Expansion, Theoretical analysis.

A theoretical investigation is made to derive the parameters that govern the dynamic similarity between prototype and model bubble plumes. It is shown in the study that, for a complete similarity between the prototype and the model, the buoyancy flux from the source, the size of the bubbles, and the expansion of gas bubbles all have to be simulated. This is translated into the observation of the Froude law, the Weber law, and the expansion law requires that, for a reduced model, the study be conducted under partial vacuum and, for an enlarged model, the study be conducted under pratial vacuum and, for an enlarged model, the study be conducted under pratise that the physical properties of common fluids

impose severe constraints in the model study. If the Weber law is to be satisfied, the smallest model permissible will only be half the prototype size. To conduct experiments under partial vacuum, the boiling of the model liquid has to be contended with. For practical reasons, a certain degree of violation of the similarity laws seems to be unavoidable. The theoretical investigation calls for systematic experiments to examine the quantitative effect of the different similarity parameters and the degree of violation of the similarity laws permissible in solving practical problems. (Author's abstract) W85-01715

HYDRODYNAMIC OF CIRCULAR PRIMARY CLARIFIERS.

Windsor Univ. (Ontario). Dept. of Civil Engineer-For primary bibliographic entry see Field 5D.

MECHANICS OF MUDFLOWS,

Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.

J. D. Higgins, B. Naik, S. V. Mills, H. Copp, and J.

A. Roberson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB84-195858, Price codes: A07 in paper copy, A01 in microfichet, Washington Water Research Center Report 51, October 1983. 116 p, 29 Fig. 3 Tab, 49 Ref, 1 Append. Project No. OWRT C-10110-V(1463)(1), Contract/Grant No. 14-34-0001-1463.

Descriptors: *Mudflows, Hydrodynamics, Flow characteristics, *Hazard assessment, Steady-state motion, *Fluid mechanics, Hydromechanics, Model studies, Bingham model, Rheology, *Turbulent flow, Velocity profiles, Friction.

The mudflow hazard associated with volcanoes or otherwise is real, yet little is understood of the fluid mechanics governing the flow. Two tasks were investigated in this research. First, common characteristics of sites where mufflows have oc-curred and mud material properties were exam-ined. Second, the equations for the fundamental hydromechanics phenomena of mudflows under restandy-state motion were developed. A Bingham model was adopted for the study of rheology and fluid mechanics of mudflows. A method was de-veloped to estimate Bingham constants given veloped to estimate Bingham constants given water content and the grain-size distribution of solids. A fluid mechanics theory of Bingham fluid flow in a wide open channel was developed, as well as equations for predicting the transition from laminar to turbulent flow. These were verified thanks the except the second of the through experiments in a flume using a mud slurry. Theories of transitional and turbulent uniform flow in smooth and rough open channels were developed. Velocity profiles and friction factors predicted by the theories were verified with experimental data. The methodologies developed to compute the flow rates for a given depth, channel characteristics, and fluid characteristics are presented as a computer program. W85-01816

BASIC CONCEPTS OF KINEMATIC-WAVE MODELS.

Geological Survey, Lakewood, CO. Water Resources Div.

For primary bibliographic entry see Field 2A. W85-02035

8C. Hydraulic Machinery

ASYNCHRONOUS GENERATOR; AN ALTER-NATIVE TO THE SYNCHRONOUS GENERA-TOR FOR SMALL HYDROELECTRIC POWER STATIONS WITH OUTPUT UP TO 20,000 KW OER ASYNCHRONGENERATOR; EINE AL-TERNATIVE ZUM SYNCHRONGENERATOR FUR KLEINE WASSERKRAFTANLAGEN MIT EINER LEISTUNG BIS 20000 KW),

Concrete-Group 8F

Brown, Boveri und Cie A.G., Baden (Switzerland) R. Kallmann.

Wasser, Energie, Luft, Vol. 76, No. 3/4, p 33-43, 1984. 21 Fig, 9 Ref.

Descriptors: *Hydroelectric powerplants, *Asynchronous generators, *Switzerland, Small hydroelectric plants, Costs, Overspeed stress.

Decreases in the energy supply and increases in its cost have combined to make small hydroelectric power stations (HEP; output 10,000-20,000 kW) more viable. Such a facility with an asynchronous generator (AG) is competitive with one having a synchronous generator (SG) due to favorable in-stallation costs, despite the necessary compensating condensors. AGs are mechanically robust and practically maintenance-free (as are SGs); have no special requirements regarding moment of inertia (SGs require a minimum flywheel mass); have a small air gap that must sometimes be enlarged due to overspeed, which influences performance; are to overspeed, which influences performance; are superior to SGs at the same output in terms of mass, space requirements, and economy; require reactive power via condensors or the network (SGs can put out or take in reactive power); need adjustable condensors or saturation throttles to maintain tension when operating alone with variable loads; have condensors requiring power-surge protection; need no synchronizing device (SGs require one for parallel operation); and, unlike SGs, do not require frequency regulation during standalone operation. The best conditions for installation of an AG are parallel operation with a standatione operation. In the best condutions for in-stallation of an AG are parallel operation with a short feed line or an SG nearby to provide reactive power. The AG can then be operated with con-stant or variable load. At the end of 1980, there were 78 AGs operating in small HEPs in Switzer-land, of which 24 were installed after 1971. Technical and economic power-output limitations, which are determined mechanically by overspeed stress rather than electrically, are about 24, 30, and 45 MW for AGs with 4, 6, and 8 poles, respectively. (Gish-IVI) W85-01858

PUMPS FOR LIQUIDS, ESPECIALLY FOR WASTEWATER (PUMPEN FUR FLUSSIGKEITEN, INSBESONDERE FUR ABWASSER),

Kantonales Amt fuer Gewasserschutz. Gallen (Switzerland). R. Weber.

Wasser, Energie, Luft, Vol. 76, No. 5/6, p 77-80, 1984. 10 Fig.

Descriptors: *Pumps, *Wastewater facilities, Water conveyance, Piston pumps, Centrifugal pumps, Particulates, Hydraulic machinery.

Pumps designed for various branches of the water and wastewater industries are described and illustrated. Next to the electric motor, the pump is considered the most versatile machine. Of the considered the most evasuate machine. Of the many types of pump, the piston and centrifugal pumps are the most important. In the water supply industry, automatic hydraulic controllers are offered as a unit and are used mainly when the water tered as a unit and are used mainly when the water supply is reliable but water pressure is not; the unit comprises a pump and pressure tank with air cushion and controller mounted on a shock-absorbent base. The Hany standard pump is used in clean or lightly polluted liquids without coarse particles, as circulation and pressure-raising pumps in water supply, heating installations, and industry; depending on engine revolution and power, pumping caing on engine revolution and power, pumping capacity is 3-380 cu m/hr (0.8-100 l/sec). In the wastewater industry, specialized pumps are needed. For polluted, untreated media containing foreign bodies as big as the pressure-connection diameter, a clog-free passage is of primary impor-tance. The 'Turo' free flow pump fulfills this crite-rion, is also economical, and runs quietly; power rion, is also economical, and runs quietly; power transfer to the pumped medium occurs according to the hydraulic coupling principle; and performance is 1-150 l/sec. The 'Ama-Drainer' is an underwater pump suited to empty and automatically keep dry excavations, shafts, and subterranean pasages. It can be used in the industrial and municipal sages. It can be used in the industrial and municipal fields for lightly polluted water with solid particles up to 10 mm in diameter. The 'Biral' wastewater and feces pump has a two-polar motor and a

choice of four wheels (swivel, single-double-, or multichannel) as well as free passage corresponding to the pressure-connection diameter guaranteed for the first three wheel types. Wastewater with solids can be pumped without clogging with the single channel or swivel wheel with a four-pole with the single channel or swivel wheel with a four-pole motor. (Gish-IVI) W85-01864

PUMP STATION DESIGN: THE BENEFITS OF

COMPUTER MODELING,
Pirnie (Malcolm), Inc., Newport News, VA.
M. P. Robinson, Jr., and R. E. Blair, Jr.
Journal of the American Water Works Association, Vol. 76, No. 7, p 70-77, July, 1984. 7 Fig. 5

Descriptors: *Computer models, *Pumping plants, *Design, *Norfolk, *Virginia, Hydraulic machinery, Mathematical models, Pumps, Valves, Water

The Norfolk, Virginia water system serves the city's residential, commercial, and industrial demands, and in addition, serves the south Hampton Roads naval facilities and provides wholesale supply to the city of Virginia Beach. Concern about the city's ability to meet the increasing about the city's ability to meet the increasing demand from Virginia Beach while maintaining reliable service to retail customers led to the use of a distribution system mathematical model for a a distribution system mathematical model for a refined analysis of explicit pump station design criteria. Specific emphasis is given to: selection of optimum efficiency design points and pump characteristics curve; selection of the most efective combination of pumps; and determination of backpressure valve control settings for the ground-level tank replenishment process. The effort expended in developing and applying mathematical models to distribution system and pump station design analyses is well repaid in the savings that result from improved design and operation. (Moore-IVI) W85-01905

8D. Soil Mechanics

SEISMIC DESIGN CRITERIA FOR BURIED WATER PIPELINE IN PUERTO RICO,

Puerto Rico Univ., Mayaguez. Dept. of Civil Engineering. For primary bibliographic entry see Field 8A. W85-01821

EARTH FOUNDATION TREATMENT AT JEBBA DAM SITE,

Montreal Engineering Co. Ltd., St. Catharines

Z. V. Solymar, B. C. Iloabachie, R. C. Gupta, and L. R. Williams. Journal of Geotechnical Engineering, Vol. 110, No. 10, p 1415-1430, October, 1984. 16 Fig, 1 Tab,

Descriptors: *Dam construction, *Jebba Dam, *Niger River, *Nigeria, *Foundation rocks, *Sand, Alluvial soils, Blasting, Vibrocompaction.

The Jebba Main Dam is founded on alluvial sands up to 230 feet in depth. In situ deep densification of loose, clean sands was required to depths as great as 131 ft below the original river bottom to provide safe foundation support for this dam on the Niger River. The required depth of treatment was unprecedented, and the volume of sand to be densified made this one of the largest in place densification projects ever undertaken. Deep blasting was used to densify the sand in the depth range of 82 ft to 131 ft below original bottom. Calculations based on measured settlements show that average improvement, in terms of relative density due to lasting over the full depth of the affected material, varies between 5 and 16 for an average of 10 percentage points. Both the treatment depth and the magnitude of explosive charges exceeded the The Jebba Main Dam is founded on alluvial sands al, values between a land of the treatment depth and the magnitude of explosive charges exceeded the corresponding values on previous projects by a factor of about two. Vibrocompaction was used to achieve the required densification to depths of 98 ft beneath the ground surface. The sand at this site was well suited for densification by this means,

with some problems arising at the beginning when procedures had to be developed to facilitate probe penetration to the required depth. Site mapping of the initial sand density from definition of zones to be densified was done using the Static Cone Penetration Test. While densification occurred immediately after blasting and during vibrocompaction, increases in penetration resistance continued over substantial time periods of weeks to months in duration. Account of this time effect should be taken in the specification and evaluation of sand densification. (Baker-IVI) W85-01871

8F. Concrete

MEASUREMENT OF CONCRETE PERME-

ABILITY, Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
B. B. Hope, and V. M. Malhotra.

Canadian Journal of Civil Engineering, Vol. 11, No. 2, p 287-292, June, 1984. 5 Fig, 1 Tab, 3 Ref. D.S.S. contract OSU80-00104.

Descriptors: *Concrete testing, *Permeability, Concrete technology, Permeability coefficient, Water/cement ratio.

Because of the generally low permeability of concrete, either the length of path along which permeability is to be measured must be relatively small or aonity is to be measured must be relatively large to avoid an undue length of time for the test. In the pro-posed method, the concrete samples are cast in epoxy resin before insertion in a pressure cell. Uniaxial water flow, under pressures up to 3.5 MPa, is ensured by O-ring seals. The higher pres-sures which can be used with this method mean that larger, more representative speciments can be that larger, more representative speciments can be used and test results obtained in a reasonable length of time. The test method and apparatus appears to present a valid means of determining coefficient of permeability for concrete mixes with coefficient of permeability for concrete mixes with a wide range of water/cement ratios and air contents. The test is adaptable in that the hydraulic gradient applied to the sample can be varied as well as the fluid used for testing. The effect of a fluid other than water, or the addition of chemicals to the water used, can be examined. (Moore-IVI)

CONCRETE IN HYDRAULIC ENGINEERING FOR A BETTER ENVIRONMENT (BETON IM WASSERBAU FUR BESSERE UMWELT), G. Brux.

Wasser, Energie, Luft, Vol. 76, No. 3/4, p 53-56, 1984. 5 Fig, 1 Tab.

Descriptors: *Concrete construction, *Hydraulic engineering, *Germany (Federal Republic), Wastewater treatment facilities, Water treatment facilities, Dam construction, Arch dams

The Kohlbrandhoft (K) wastewater treatment facility handles 88% of Hamburg's (Federal Republic of Germany) municipal wastewater (0.5 million cu m/day) and is situated on an artificial peninsula at the confluence of the Norderelbe and Kohlbrand (Suderelbe) rivers. With the 1973 expansion of the Nord plant, lack of space meant the abundonment of conventional construction techniques: very deep preliminary-treatment basins with funnels in the center, block construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the activation facility, and tertiary-treatment tanks built on top of one another. during construction of the activation facility, and tertiary-treatment tanks built on top of one another. Similar conditions existed during construction of the biological stage at K Sud (start-up in 1983), which has double-decker tertiary treatment, small settling tanks with horizontal flow built in block fashion behind larger, vertical-flow tanks, and six activation tanks with five aeration cycles operated in cascade form. The phosphate-removal facility at the 4-sq-m Tegelersee in West Berlin comprises an intake complex and a filtration/floculation facility. The North Trench complex (intake facility, macrorake, intake basin, aludge (intake facility, macrorake, intake basin, studge bins, weir, outlet facility, and cascades) is situated

8G. Materials

CORROSION AND PROTECTION OF PIPES IN DEVELOPING COUNTRIES, ary bibliographic entry see Field 8A.

USEFULNESS OF MEASURING THE CORRO-SION RATES OF SOILS (UTILITE DES ME-SURES DE CORROSIVITIE DES SOLS), Naples Univ. (Italy). Facolta di Ingegneria. M. Arpaia. Aqua, No. 4, p 168-172, 1983. 3 Fig, 3 Tab, 19 Ref.

Descriptors: *Corrosive soils, *Pipes, *Coatings, Soil chemistry, Soil physical properties, Resistivi-ty, Hydrogea ion concentration, Soil water, Sul-fates, Chlorides, Soil bacteria.

Soil corrosivity can be a problem for buried pipes, and it is difficult to predict the corrosivity of soils based upon their physical and chemical characteristics. Soil factors which may be used to determine the corrosivity include: electrical resistivity, soil water, pH, sulfates, chlorides, sulfate and iron bacwater, pH, sulfates, chlorides, sulfate and iron bacteria, and oxygen content. Different types of pipe coatings have been used to protect buried pipes, including adherent and nonadherent coatings, and active coatings. Engineers can use information on the corrosivity of soils to determine what kind of protection may be necessary for water distribution networks, but there are questions as to whether getting information on soil corrosion rates is economical. (Moore-IVI) W85-01992

CORROSION BEHAVIOUR OF CAST IRON

PIPES, Swiss Corrosion Commission, Zurich.

Aqua, No. 4, p 183-187, 1983. 9 Fig. 3 Tab, 9 Ref.

Descriptors: *Pipelines, *Corrosion, Pipes, Soil properties, Resistivity, Concrete, Gravel.

Pipelines made of grey or ductile cast iron exhibit very good corrosion resistance in soils, provided that the formation of macro-elements as a result of non-homogeneous bedding or an electrical contact with foreign cathodes or stray current effects can be avoided. Stray current effects and macro-ele-ment formation have electrochemically the same ment formation have electrochemically the same reaction mechanism. Stray current corrosion is induced by the voltage drop in the rail, whereas macro-element formation is a galvanic effect, the driving force for which stems from the corrosion potential difference. Various possibilities exist for the protection against macroelement formation, such as high-resistivity homogeneous backfill for the pipeline or the insulation of the pipeline from the soil. In the presence of foreign cathodes the high resistivity backfill provides a sure method of protection. Other methods of protection against the action of stray currents include reduction of the longitudinal conductivity as well as the drain-

age and forced drainage which are using the stray current as protective current for the pipeline. (Baker-IVI) W85-01994

VARIOUS COATING MATERIALS FOR POTA-BLE WATER CONCRETE STORAGE RESER-VOIRS - EXPERIENCES IN GERMANY, SWIT-ZERLAND AND AUSTRIA, Vandex Isoliermittel G.m.b.H., Hamburg (Germa-

ny, F.R.). H. Pfundt

Aqua, No. 5, p 235-236, 1983. 2 Fig.

Descriptors: *Water storage, *Water quality control, *Linings, *Storage reservoirs, Reservoirs, Construction, Pipelines, Coatings.

In order for water to maintain its quality during storage after treatment, the lining of reservoirs and pipes is particularly important. A coating must be waterproof, with smooth surface and good appearance, insoluble in water, and shall not contain any toxic or other harmful components, have a long life, not give rise to microbial growths, be easy to apply and be economical. Current mortar linings have advantages over other types of coatings as apply and de economical. Current morrar imnigs have advantages over other types of coatings as they contain no organic matter and there is there-fore no danger from microbial growth as with organic coatings. Current slurry coatings are easy to apply but the preparation work necessary on surfaces to ensure a satisfactory result is extensive. (Baker-IVI) W85-02000

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

WATER RESOURCES DIVISION TRAINING CATALOG,
Geological Survey, Lakewood, CO. Water Resources Div.

W. R. Hotehkiss, and L. A. Foxhoven. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Geological Survey Open-File Report 83-945, 1984. 162 p, 2 Fig, 3 Tab.

Descriptors: *Training, *Education, Water resources, *Catalogs, Training manuals, Training facilities, Federal agencies.

The National Training Center provides technical and management sessions nesessary for the conductance of the U.S. Geological Survey's training programs. This catalog describes the facilities and staff at the Lakewood Training Center and describes Water Resources Division training courses soughbly the prochables of the procession of the conduction of th available through the center. In addition, the catalog describes the procedures for gaining admission, formulas for calculating fees, and discussion of course evaluations. (USGS) W85-02032

9D. Grants, Contracts, and Research Act Allotments

HIGHLIGHTS OF THE 1983 FEDERAL-STATE COOPERATIVE WATER RESOURCES PRO-GRAM, Geological Survey, Reston, VA. Water Resources

B. K. Gilbert, and T. J. Buchanan. Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 83-763, 1983. 36 p, 4 Fig, 5 Tab, 3 Ref.

Descriptors: *Water resources, *Federal-State co-operation, *Hydrologic data, State governments, Local agencies.

The U.S. Geological Survey Federal-State Cooperative Water Resources Program in fiscal year 1983 continued to concentrate on investigations of highest priority to the Nation. Hydrologic data collection and interpretive studies were underway in every State, Puerto Rico, and several U.S. territories with focus on such current concerns as ground-water contamination, floods, impacts of ground-water contamination, floods, impacts of toxic wastes, acid precipitation, and stream quality. During the year, this 50-50 matching program was carried out in working partnership with more than 800 State, regional, and local agencies. Joint funding from all sources totaled approximately \$92 million. Details of the program are mutually negotiated at the working level by representatives of the Survey and representatives of the cooperating agencies. The pooling of interests results in a balanced effort that directs combined resources to hydrologic investigations, having the most signifiancet error that directs combined resources to hydrologic investigations having the most signifi-cance to both parties. A few of the highlights for FY 1983, and how the program is developed with other agencies are described. (USGS) W85-01829

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ACTIVITIES OF THE ALASKA DISTRICT, WATER RESOURCES DIVISION, U.S. GEO-LOGICAL SURVEY, 1984.

Geological Survey, Anchorage, AK. Water Re-

Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225. USGS Open-File Report 84-246, 1984. 34 p. Snyder, E.F., compiler.

Descriptors: Hydrology, Project planning, Bibliographies, *Alaska, *Water resources projects.

Twenty-two projects active in 1984 are described. Each description includes information on period of Project, chief, funding sources, location, purpose, current status, and published or planned reports. The compilation also contains a bibliography of reports published by the Alaska Distict from 1977 through 1983. (USGS)

W85-01825

SELECTED BIBLIOGRAPHY OF WATER RE-SOURCES PUBLICATIONS FOR MISSISSIPPI, Geological Survey, Jackson, MS. Water Resources

G. G. Parker, Jr., D. Walker, and C. Moss. USGS Open-File Report 84-062, 1984. 78 p, 2 Fig,

Descriptors: *Bibliographies, Publications, *Missis-

The first edition of the Mississippi Water resources bibliography lists publications that come from a broad spectrum of sources and vary greatly in content. Many of the reports are U.S. Geological Survey publications that interpret and summarize the results, or present the basic data collected in the cooperative programs that are jointly funded with State, local, and other federal agencies. The bibliography also includes selected reports published by State and local agencies in Mississippi and adjoining states, and other federal agencies. The basic criteria used for inclusion of a publication were that the report: (1) contain data or interpretative information related to water resources or (2) the report be useful in developing additional data or interpretative studies related to water resources. To allow easy entry and retrieval, the bibliography is organized into four appendices titled Master List, Disciplines, River Basins, and Geographical Areas. (USGS) The first edition of the Mississippi Water resources Geographical Areas. (USGS) W85-02033

SUBJECT INDEX

ACANTHASTER Terrestrial Runoff as a Cause of Outbreaks of Acanthaster planci (Echinodermata: Asteroi-	Impact of Acidification and Eutrophication on Macrophyte Communites in Soft Waters. II. Ex- perimental Studies,	AEROBIC DIGESTION Aerobic Sludge Digestion with pH Control - Preliminary Investigation,
dea),	W85-01889 5C	W85-01660 5D
W85-01893 5C	Effects of Acidification on the Ecology of	AGGREGATION
ACCRETION	Streams in the Upper Tywi Catchment in West	Coagulation and Restabilization of Particulate,
Recent Vertical Accretion Rates at Blackwater	Wales, W85-02116 5C	Macromolecular and Protected Organic Aqua-
Wildlife Refuge,	W85-02116 5C	sols by Aluminum (III),
W85-01809 2L	ACIDIFIED LAKES	W85-02105 5F
ACID LAKES	Acidified Lakes: Sediment Treatment with	AGRICULTURAL CHEMICALS
Short-Term Changes in the Base Neutralizing Capacity of an Acid Adirondack Lake, New	Sodium Carbonate - A Remedy, W85-02096 5G	Pesticides in Groundwater Beneath the Central Sand Plain of Wisconsin,
York,	ACIDITY CONSTANTS	W85-02025 5B
W85-01917 5B	Simultaneous Determination of Partition Coeffi-	
ACID MINE DRAINAGE	cients and Acidity Constants of Chlorinated Phenols and Guaiacols by Gas Chromatography,	AGRICULTURAL DEVELOPMENT
Application of Remote-Sensing Techniques to	W85-02115 5A	Irrigated Agricultural Expansion Planning in Developing Countries: Resilient System Design,
Hydrologic Studies in Selected Coal-Mined		W85-02144 6A
Areas of Southeastern Kansas, W85-01947 5B	ACTIVATED CARBON	W03-02144
W85-01947 5B	Adsorption of Copper, Lead and Cobalt by Ac- tivated Carbon,	AGRICULTURE
ACID MINE WATER	W85-01717 5D	Ensuring a High Level of Effectiveness and
Effects of Phosphate Fertilizer Applications and		Intensity of Agricultural and Water-Manage-
Chemistry-Mineralogy of the Iron Oxide System	Ozonation and Activated Carbon Filtration: a	ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi-
on Phosphate Adsorption-Desorption by Stream	Critical Evaluation, W85-02019 5F	tat der landwirtschaftlichen und wasserwirts-
Sediments, W85-01794 5B		chaftlichen Produktion in Trinkwasser-Einzugs-
W 63-01794 3B	ACTIVATED SLUDGE PROCESS	gebieten),
ACID PRECIPITATION	Computer Controlled Operation of an Activated	W85-01883 4D
Potential for Acidification of Six Remote Ponds	Sludge Plant, W85-01652 5D	
in the White Mountains of New Hamphire,	W85-01652 5D	AHMEDABAD
W85-01834 5B	Pilot Plant Demonstration of Biological Phos-	Current Water Treatment Practices in Western India - Case Studies of Two Metropolitan Cities,
ACID RAIN	phorus Removal,	Bombay and Ahmedabad,
Acid Precipitation and Scientific Uncertainty	W85-01657 5D	W85-02024 5F
Problems in Probability,	Aerobic Sludge Digestion with pH Control -	***************************************
W85-01665 5C	Preliminary Investigation,	AIR POLLUTION
Economics of Acid Rain: An Invisible Hand of	W85-01660 5D	Some Observations on the Chemical Composi-
Control,	Organic and Inorganic Mercury Species in the	tion of Precipitation in an Industrial Area and
W85-01666 5C		It's Use in Air Quality Assessment, W85-02129 5B
Tort Recovery of Acid Rain Damages in the	W85.01798 5D	ALABAMA
United States - Observations on Plaintiff's Prima	ADENINE NUCLEOTIDES	Drought in Southeastern United States,
Facie Case, W85-01667 6E		W85-01642 2B
Acid Rain and Federal Common Law,	grass),	Water Resources Data, Alabama, Water Year
W85-01668 6E		1982, W85-01939 2E
Legal Aspects of Acidic Precipitation,	ADSORPTION	W 63-01939 2E
W85-01669 6E		ALASKA Sediment Transport in the Tanana River near
International Cooperation and Acid Rain Pollu-	W85-01717 5D	Fairbanks, Alaska, 1982,
tion: Establishing the Framework for Control		W85-01769 2J
W85-01670 6E		P. C. C. S. W. P.
Influence of Acid Precipitation on Stream Inver-	Solutions by Waste Tyre Rubber, W85-01724 5D	Reconnaissance of Surface Water Resources in the Togiak River Basin, Southwestern Alaska,
tebrates,		1980 and 1982,
W85-01807 5C	Adsorption of Surfactants on Sediments,	W85-01777 2A
Potential for Asidification of Cir. Pours	W85-01960 5A	
Potential for Acidification of Six Remote Ponds in the White Mountains of New Hamphire, W85-01834	Phosphate Adsorption Kinetics of Resuspended	Sediment Transport in the Tanana River near Fairbanks, Alaska, 1980-81,
	Austria,	W85-01788 2J
Short-Term Changes in the Base Neutralizing		Activities of the Alaska District, Water Re-
Capacity of an Acid Adirondack Lake, New	AERATED LAGOONS	sources Division, U.S. Geological Survey, 1984.
York,	Study Cases of Operative Conditions of Munici-	W85-01825 10C
W85-01917 5E	pal Treatment by Lagooning (Etude des Condi-	
Effects of Acidification on the Ecology o	tions de Fonctionnement et d'Exploitation de	ALBERTA
Streams in the Upper Tywi Catchment in Wes	Quelques Cas Concrets de Traitement d'Eaux Residuaires Urbaines par Lagunage),	Pesticide and PCB Levels in Fish from Alberta (Canada).
Wales,	W95 01076 SD	W85-01954 5A
W85-02116 50		
Some Observations on the Chemical Composi	AERATION	Spatial Heterogeneity in Whole Lake Sediments
tion of Precipitation in an Industrial Area and		- Towards a Loading Estimate,
It's Use in Air Quality Assessment,	W85-01706	W85-02073 2H
W85-02129 51	activities a second control of the second	ALDICARB
ACIDIFICATION	Biological Filters,	Quantitative Determination of ppb Levels of
Potential for Acidification of Six Remote Pond	W85-01736 5D	Carbamate Pesticide in Water by Capillary Gar
in the White Mountains of New Hamphire,	Quality Aspects of the Biesbosch Reservoirs,	Chromatography,
W85-01834 51	W85-01979 5G	W85-01747 5A

ALDICARB

Determination of Aldicarb and its Derivatives in Groundwaters by High-Performance Liquid Chromatography with UV Detection,	Feasibility Study of Developing Valley-Fill Aquifers for Village Water Supplies in Southern Guam, W85-02026	AQUATIC HABITATS Study of Habitat Conditions of the Macrophytic Vegetation in Selected River Systems in West- ern Lower Saxony (Federal Republic of Germa-
W85-01748 5A	W85-02026	ny),
ALEXANDRIA	ALLUVIAL STREAMS	W85-01887 2H
Water Supply of Alexandria Egypt,	Objective Identification of Pools and Riffles, W85-02159 2E	AQUATIC WEED CONTROL
W85-01985 5F	W85-02159 2E	Investigation of Two Possible Modes of Action
ALGAE	ALUMINA	of the Inert Dye Aquashade on Hydrilla,
Analysis of Pollutant Enhanced Bacterial Blue-	Material Balance Analysis for Fluoride Ions in	W85-02122 4A
Green Algal Interrelationships Potentiating Sur-	Experimental Waste Disposal Plant, W85-01732 5D	AQUATIC WEEDS
face Water Contamination by Noxious Blue- Green Algal Blooms,	W63-01732	Water Hyacinth Canopy and Pan Evaporation,
W85-01803 5C	ALUMINUM	W85-02128 4A
W45-01005	Influence of Acid Precipitation on Stream Inver-	ACTION
Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/	tebrates, W85-01807 5C	AQUIFER Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi, April, 1982,
Water Partition Coefficient and Bioaccumula- tion of Organic Chemicals by Alga Chlorella,	ALUMINUM COMPOUNDS	W85-01926 7C
W85-01959 5B	Coagulation and Restabilization of Particulate, Macromolecular and Protected Organic Aqua-	Aquifer Tests in the Stratified Drift, Chipuxet
Algal-Availability of Particulate Phosphorus	sols by Aluminum (III),	River Basin, Rhode Island, W85-02039 2F
from Diffuse and Point Sources in the Lower	W85-02105 5F	W85-02039 2F
Great Lakes Basin, W85-02061 2K	ALUMINUM III SALTS	AQUIFER CHARACTERISTICS
W 65-02001	Coagulation and Restabilization of Particulate,	Distribution of Selected Chemical Constituents
Available Phosphorus in Lake Sediments in the	Macromolecular and Protected Organic Aqua-	in Water from the Floridan Aquifer, Southwest
Netherlands,	sols by Aluminum (III), W85-02105 5F	Florida Water Management District, W85-01928 7C
W85-02092 2H	W 63-02103	W 63-01926
ALGAL ASSAY	AMMONIUM	Appraisal of Water from Surficial-Outwash
Response of Algal Populations to Changes in	Effects of Ammonium Effluents on Planktonic	Aquifers in Todd County and Parts of Cass and
Stream Water Quality,	Primary Production and Decomposition in a Coastal Brackish Water Environment. I. Interre-	Morrison Counties, Central Minnesota, W85-02038 4B
W85-01797 5C	lations Between Abiotic and Biotic Components	W 83-02038 4B
ALGAL GROWTH	of the Planktonic Ecosystem,	AQUIFER SYSTEMS
Modeling Algal Behaviour in the River Thames,	W85-01840 5C	Altitude of the Top of the Matawan Group-
W85-01720 5G	Flore of Bodond Chaminal Considerate	Magothy Formation, Suffolk Country, Long
	Flux of Reduced Chemical Constituents (Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-	Island, New York, W85-02030 7B
Release of Sediment-Phosphorus and the Influ- ence of Algal Growth on This Process,	ment Oxygen Demand in Lake Erie.	15
W85-01761 2H	W85-02087 2H	AQUIFER TESTING
	ANN ARROR	Exploratory Drilling and Aquifer Testing at the
Phytoplankton Population Dynamics of a Small	ANN ARBOR Ann Arbor Controls Trihalomethanes,	Kipahulu District Haleakala National Park, Maui, Hawaii,
Reservoir: Effect of Intermittent Mixing on Phy- toplankton Succession and the Growth of Blue-	W85-01911 5F	W85-01776 2F
green Algae,		
W85-01916 2H	ANNUAL SEDIMENT LOAD	AQUIFER TESTS
	Sediment Transport in the Lower Yampa River, Northwestern Colorado,	Instrumentation Used for Hydraulic Testing of Potential Water-Bearing Formations at the
Algal-Availability of Particulate Phosphorus from Diffuse and Point Sources in the Lower	W85-02045 2J	Waste Isolation Pilot Plant Site in Southeastern,
Great Lakes Basin,		New Mexico,
W85-02061 2K	ANTIBIOTIC RESISTANCE	W85-01827 7B
	Association of Metal Tolerance with Multiple Antibiotic Resistance of Bacteria Isolated from	Geohydrologic Data for Test Well USW G-4,
Epilimnetic Nutrient Loading by Metalimnetic	Drinking Water,	Yucca Mountain Area, Nye County, Nevada,
Erosion and Resultant Algal Responses in Lake Waramaug, Connecticut,	W85-02133 5F	W85-02031 7C
W85-02093 2H	P	
	Effect of Chlorination on Antibiotic Resistance Profiles of Sewage-Related Bacteria,	AQUIFERS Water-Level Changes in the High Plains Re-
ALGICIDES	W85-02139 5D	gional Aquifer, Northwestern Oklahoma, Prede-
Chlorine as an Algicide in a Conventional Water Treatment Plant,		velopment to 1980,
W85-01749 5F	APALACHICOLA ESTUARY	W85-01771 2F
	Soils of Swamps in the Apalachicola, Florida, Estuary,	Ground-water Quality in the Western Snake
ALICURA	W85-01641 2L	River Basin, Swan Falls to Glenns Ferry, Idaho,
Construction of the Alicura Hydroelectric Facil- ity in Argentina (Der Bau der Wasserkraftanlage		W85-01784 2F
Alicura in Argentinien),	MI ROI RIME I ECILIO EO O I	W
W85-01862 8A	Practical Water Treatment for Communities in Developing Countries,	Major Aquifers in Miner County, South Dakota, W85-01950 2F
	W85-01983 5F	W 63-01730 21
ALKALINITY Detection for Assistance of Six Bounds Bounds		Altitude and Generalized Configuration of the
Potential for Acidification of Six Remote Ponds in the White Mountains of New Hamphire,	- Propries recembiogy to improve Dimanig	Top of the Floridan Aquifer, St. Johns County,
W85-01834 5B	Water Quality, W85-02014 5F	Florida, W85-02050 7C
ALLUVIAL AQUIFER	APPROXIMATION METHOD	Parameter Identification of Groundwater Aqui-
Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi, April, 1982,		fer Models: A Generalized Least Squares Ap-
W85-01926 7C	January 1981, Southwestern Kansas, W85-01930 7C	proach, W85-02164 2F
ALLUVIAL AQUIFERS	AQUASHADE	AREAL PRECIPITATION
Water-Level Maps of the Alluvial Aquifer in Northwestern Mississippi, April 1983.	Investigation of Two Possible Modes of Action of the Inert Dye Aquashade on Hydrilla,	Areal Reduction Factors on Short: Time and Space Intervals.
W85-01944 7C		W85-01690 2B

AREAL RAINFALL	AUSTRALIA	Association of Metal Tolerance with Multiple
Real-Time Estimation and Forecasting of Spa-	Aromatic Hydrocarbons in Waters of Port Phil-	Antibiotic Resistance of Bacteria Isolated from
tially Distributed Areal Rainfall, W85-01700 2B	lip Bay and the Yarra River Estuary,	Drinking Water, W85-02133 5F
W83-01700 2B	W85-01644 5B	W85-02133
ARGENTINA	Seasonal Meromixis in Three Hypersaline Lakes	Relative Contributions of Bacteria and Fungi to
Construction of the Alicura Hydroelectric Facil- ity in Argentina (Der Bau der Wasserkraftanlage	on Rottnest Island, Western Australia, W85-01645 2H	Rates of Degradation of Lignocellulosic Detri- tus in Salt-Marsh Sediments,
Alicura in Argentinien),		W85-02138 2L
W85-01862 8A	AUSTRIA	Control of the Lorentz Control of the Control of th
ARIZONA	Weinzodl Power Station on the Mur (Das Kraftwerk Weizodl an der Mur),	BACTERIAL ANALYSIS
Yield and Quality of Cotton Grown with	W85-01860 8A	Effect of Noncoliforms on Coliform Detection in Potable Groundwater: Improved Recovery
Wastewater,		with an Anaerobic Membrane Filter Technique,
W85-01869 5D	Erosion Control at High Altitudes (Erosionsbe- kampfung im Hochgebirge),	W85-02140 5F
ARKANSAS	W85-01863 4D	BAFFLES
Water Resources Data, Arkansas, Water Year		Effects of Baffles on the Performance of Model
1982, W85-01934 2E	Phosphate Adsorption Kinetics of Resuspended Sediments in a Shallow Lake, Neusiedlersee,	Waste Stabilization Ponds,
	Austria,	W85-01719 5D
ARMOR LAYERS	W85-02079 2H	BALDEGGERSEE
Design of Armour Systems for the Protection of Rubble Mound Breakwaters,	AUTOMATION	Development of the Condition of the Baldegger-
W85-01707 2J	Computer Controlled Operation of an Activated	see (1900 to 1980) and the Effect of Intralake
ARSENIC	Sludge Plant,	Procedures (Die Zustandsentwicklung dis Bal-
Statistical Analysis of Estuarine Profiles: II Ap-	W85-01652 5D	deggersees (1900 bis 1980) und die Auswirkung von seeinternen Massnahmen),
plication to Arsenic in the Tamar Estuary (S.W.	New Instrumentation in Automatic Water Qual-	W85-01865 5C
England), W85-01914 5B	ity Monitoring,	
W85-01914 5B	W85-02007 5G	BALTIC SEA
Dynamics and Mechanisms of Arsenite Oxida-	Micro-Electronics in the Water Industry - A	Effects of Ammonium Effluents on Planktonic Primary Production and Decomposition in a
tion by Freshwater Lake Sediments, W85-02080 5B	Review of Present and Probable Future Devel-	Coastal Brackish Water Environment. I. Interre-
W85-02080 5B	opments,	lations Between Abiotic and Biotic Components
ARTIFICIAL WETLANDS	W85-02008 6A	of the Planktonic Ecosystem,
Use of Artifical Wetlands to Remove Nitrogen Compounds from Wastewater,	Towards Total Automation of Water Distribu-	W85-01840 5C
W85-01978 5D	tion (Vers l'Automatisation Integrale dans la	BARCELONETA
	Distribution d'Eau), W85-02009 6A	Volatile Organic Inputs from an Ocean Outfall
ASHLEY RIVER Critical Depths for Passage in Braided Rivers,	W85-02009 6A	Near Barceloneta, Puerto Rico, W85-01963 5E
Canterbury, New Zealand,	Automated Sensor Systems for Water Resource	W 63-01703
W85-01636 2E	Pollution Warning and Treatment Process Con- trol,	BASE FLOW
ASYNCHRONOUS GENERATORS	W85-02010 5F	Ground-Water Hydrology and Quality before and after Strip Mining of a Small Watershed in
Asynchronous Generator; An Alternative to the		Jefferson County, Ohio,
Synchronous Generator for Small Hydroelectric	Automated Water Laboratory - What Benefit to the Consumer,	W85-01943 4C
Power Stations with Output up to 20,000 kW (Der Asynchrongenerator; Eine Alternative zum	W85-02011 7B	
Synchrongenerator fur kleine Wasserkraftanla-		BASE NEUTRALIZING CAPACITY Short-Term Changes in the Base Neutralizing
gen mit einer Leistung bis 20000 kW),	Case for Automated Water Management, W85-02130 6A	Capacity of an Acid Adirondack Lake, New
W85-01858 8C	W 83-02130 6A	York,
ATLANTIC DRAINAGE	AVERAGE ANNUAL INSTREAM USE	W85-01917 5B
Daily Water and Sediment Discharges from Se-	Quantifying the Relative Performance of Alter- native Measures for Fulfilling Instream Uses in	BASELINE STUDIES
lected Rivers of the Eastern United States: A Time-Series Modeling Approach,	the Plains Environment,	Ground-water Quality in the Western Snake
W85-01823 2J	W85-02107 6B	River Basin, Swan Falls to Glenns Ferry, Idaho,
	BACTERIA	W85-01784 2F
ATMOSPHERIC DEPOSITION Net Atmospheric Inputs of PCBs to the Ice	Distribution and Periodicity of Total, Faecal	BAY LANDS
Cover on Lake Huron,	Coliform Bacteria in an Aquatic Ecosystem,	Sediment Concentrations from Intensively Pre-
W85-01759 5B	W85-01675 5B	pared Wetland Sites,
ATOLLS	Oxygen Depletion in Central and Eastern Lake	W85-02112 4C
Comparision of Water Catchment and Storage	Erie: Relationship with Bacteria, Chlorophyll,	BEACHES
Systems in Two Micronesian Atoll Communi-	POC, and Morphometry,	Beach Fecal Coliforms,
ties: Laura and Nama, W85-02028 6D	W85-01752 2H	W85-01711 5B
	Effect of Treatment with a Commercial Bacte-	BED MATERIAL
ATRAZINE Effects of the Herbicide Atrazine on an Oyster-	rial Suspension on Water Quality in Channel Catfish Ponds,	Sediment Transport in the Tanana River near
Food Organism,	W85-01922 5F	Fairbanks, Alaska, 1980-81, W85-01788 2J
W85-01808 5C		W85-01788 2J
Effects of the Herbicide Atrazine on Adenine	Bacteria in Works and Mains from Ground Water Supplies,	BEDLOAD
Nucleotide Levels in Zostera marina L. (Eel-	W85-02001 5F	Sediment Transport in the Tanana River near
grass),		Fairbanks, Alaska, 1982, W85-01769 2J
W85-01888 5C	Drinking Water in Developing Countries - The Minimum Treatment Philosophy. A Case Study,	W 03-01/03
ATTAWAPISKAT RIVER	W85-02018 3B	BEHAVIOR
Morphology and Recent Sediments of the		Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte-
Lower Anastomosing Reaches of the Attawapis- kat River, James Bay, Ontario, Canada,	Manganese Cycle in Lac Leman, Switzerland: The Role of Metallogenium,	mora affinis (Copepoda),

BEIRUT Chlorine as an Algicide in a Conventional Water Treatment Plant,	BIOFILMS Nonsteady-State-Biofilm Process for Advanced Organics Removal,	Santa Ana River: An Example of a Sandy Braid- ed Floodplain System Showing Sediment Source Area Imprintation and Selective Sediment Modi-
W85-01749 5F	W85-01658 5D	fication, W85-01735 2J
BENTHIC ANIMALS	Rapid BOD Measurement for Municipal	#85-01755
Responses of Developing Estuarine Macro- benthic Communities to Drilling Muds,	Wastewater Samples using a Biofilm Electrode, W85-01739 5D	BREAKWATERS Design of Armour Systems for the Protection of
W85-01845 5C	BIOINDICATORS	Rubble Mound Breakwaters, W85-01707 2J
BENTHIC ENVIRONMENT	Pollution Effects Monitoring With Foraminifera	25
Man-Made Structures on Marine Sediments: Effects on Adjacent Benthic Communities, W85-01895 6G	as Indices in the Thana Creek, Bombay Area, W85-01671 5C	BRITISH COLUMBIA Logging Impacts and Some Mechanisms that Determine the Size of Spring and Summer Pop-
BENTHIC INVERTEBRATES Reconnaissance of Surface Water Resources in	Mytilus galloprovincialis and Parapenaeus lon- girostris as Bioindicators of Heavy Metal and Organochlorine Pollution,	ulations of Coho Salmon Fry (Oncorhynchus kisutch) in Carnation Creek, British Columbia,
the Togiak River Basin, Southwestern Alaska,	W85-01899 5A	W85-01919 5C
1980 and 1982, W85-01777 2A	Spatial and Temporal Trends in Heavy Metal	BUBBLE PLUMES Modelling Criteria for Bubble Plumes - A Theo-
	Concentrations in Mussels from Northern Ire-	retical Approach,
BENTHOS Organic Wastewater Effects on Benthic Inverte-	land Coastal Water, W85-01901 5A	W85-01715 8B
brates in the Manawatu River,	Aquatic Leeches (Hirudinea) as Bioindicators of	BULKING SLUDGE
W85-01632 5C	Organic Chemical Contaminants in Freshwater	Enzymatic Hydrolysis Tests on an Industrial Effluent Prior to its Biological Purification
Removal of Volatile Organic Pollutants from	Ecosystems, W85-01958 5A	(Essais d'Hydrolyse Enzymatique d'un Effluent Industriel avant son Epuration Biologique),
Rapid Streams,		W85-01975 5D
W85-01738 5B	BIOLOGICAL TREATMENT Effect of Treatment with a Commercial Bacte-	BUNZ VALLEY
BIBLIOGRAPHIES	rial Suspension on Water Quality in Channel	Origin of Nitrates in Groundwater of the Bunz
Selected Bibliography of Water Resources Pub-	Catfish Ponds,	Valley (Woher stammen die Nitrate im Grun-
lications for Mississippi, W85-02033 10C	W85-01922 5F	wasser des Bunztales),
W 83-02033	BIOMONITORING	W85-01856 5B
BIESBOSCH RESERVOIRS	Response of Algal Populations to Changes in	CADMIUM
Quality Aspects of the Biesbosch Reservoirs, W85-01979 5G	Stream Water Quality, W85-01797 5C	Mechanisms of Metal Adsorption from Aqueous Solutions by Waste Tyre Rubber,
BIOACCUMULATION	BIOREACTORS	W85-01724 5D
Accumulation of the Trace Elements Lead and Zinc by Asellus communis at Three Different	Mechanism of Semifluidized Bed Bioreactor for Biological Phenol Degradation,	Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte-
pH Levels, W85-01795 5B	W85-02106 5D	mora affinis (Copepoda), W85-01900 5C
	BIOTURBATION	
Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/ Water Partition Coefficient and Bioaccumula-	Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh, Northern Ireland,	CAFFEINE Kinetics and Products of the Chlorination of Caffeine in Aqueous Solution,
tion of Organic Chemicals by Alga Chlorella, W85-01959 5B	W85-02085 2H	W85-01727 5B
	BOB LAKE	CALCITE
Response of Algal Populations to Changes in Stream Water Quality,	Historical Changes in Anthropogenic Lead Fall- out in Southern Ontario, Canada, W85-02063 5B	Kinetic Factors of CaCO3-Precipitation and the Partitioning of 12C and 13C. Studies at the Wa- terfalls of Guterstein and Urach (Schwabische
W85-01797 5C		Alb) (Kinetische Faktoren der CaCO3-Abschei-
BIOASSAYS	Factors Structuring Fish Assemblages Along a	dung und der Fraktionierung von 12C und 13C.
Available Phosphorus in Lake Sediments in the Netherlands,	Bog Lake Successional Gradient, W85-01891 2H	Untersuchungen an den Wasserfallen von Guter- stein und Urach (Schwabische Alb)), W85-01662
W85-02092 2H	BOMBAY	
BIOAVAILABILITY	Pollution Effects Monitoring With Foraminifera	CALIFORNIA Ground Water in the Twenty-Nine Palms Indian
Bioavailability of Pb and Zn from Mine Tailings as Indicated by Erythrocyte delta-Aminolevu- linic Acid Debydrates (ALA D) Acidity in	as Indices in the Thana Creek, Bombay Area, W85-01671 5C	Reservation and Vicinity, San Bernardino County, California,
linic Acid Dehydratase (ALA-D) Activity in Suckers (Pisces: Catostomidae),	Current Water Treatment Practices in Western	W85-01779 2F
W85-01918 5A	India - Case Studies of Two Metropolitan Cities, Bombay and Ahmedabad,	Hepatic Mixed-Function Oxidases in California Flatfishes are Increased in Contaminated Envi
BIOCHEMICAL OXYGEN DEMAND Stochastic Model for BOD and DO in Streams	W85-02024 5F	ronments and by Oil and PCB Ingestion, W85-01894 5A
When the Velocity is Random and Distance- Dependent,	BOSMINA Trophic Ecology of Fish Rearing Ponds,	Man-Made Structures on Marine Sediments: Ef
W85-01676 5B	W85-01833 2H	fects on Adjacent Benthic Communities, W85-01895
Rapid BOD Measurement for Municipal	BOTTOM SAMPLING Bottom Dynamics in Lakes	
Wastewater Samples using a Biofilm Electrode, W85-01739 5D	Bottom Dynamics in Lakes, W85-02054 2J	Data for Ground-Water Test Hole near Nico laus, Central Valley Aquifer Project, California W85-01929 70
BIODEGRADATION	BOTTOM SEDIMENTS	
Biodegradability Testing of Poorly Water Solu- ble Compounds, W85-01957 5B	Bottom Dynamics in Lakes, W85-02054 2J	Data for Ground-Water Test Hole Near Butt City, Central Valley Aquifer Project, California
	BRAIDED STREAMS	W85-01941 70
Mechanism of Semifluidized Bed Bioreactor for Biological Phenol Degradation.		Ground Water in the Redding Basin, Shasta an
W85-02106 5D	Canterbury, New Zealand, W85-01636 2E	Tehama Counties, California, W85-01945

Managing Water Scarcity: An Evaluation of In- terregional Transfers, W85-02145 6F	CATCHMENT AREAS Comparision of Water Catchment and Storage Systems in Two Micronesian Atoll Communi-	CHEMICAL INDUSTRY Development of the Schwarzheide Chemical Synthesis Works in the Field of Wastewater and
CAMPYLOBACTER Seasonal Study of a Freshwater Lake and Mi-	ties: Laura and Nama, W85-02028 6D	By-product Treatment (Entwickling des VEB Synthesewerk Schwarzheide auf dem Gebiet der Abwasser- und Abproduktbehandlung),
gratory Waterfowl for Campylobacter Jejuni, W85-01639 5B	CATCHMENTS Nash Model Relation to Horton Order Ratios, W85-02158 2A	W85-01881 5D CHEMICAL IONIZATION MASS SPECTRA
CANADA Legal Aspects of Acidic Precipitation, W85-01669 6E	CATFISH FARMING Effect of Treatment with a Commercial Bacterial Suspension on Water Quality in Channel	Identification of Nonionic Detergents by GC/ CI-MS: I. A Complementary Method or an At- tractive Alternative to GC/EI-MS and Other
CANADIAN CLEAN AIR ACT Legal Aspects of Acidic Precipitation,	Catfish Ponds, W85-01922 5F	Methods, W85-01955 5A
W85-01669 6E	CAYUGA LAKE Partitioning of Phosphorus Between Particles	CHEMICAL PROPERTIES Particle Size Distribution and Chemical Param-
CANAL CREEK Microbial Degradation of 2,4,6-Trichloroaniline in Aquatic Samples and Laboratory Enrichment	and Water in a River Outflow, W85-02075 2H	eters of the Sediments of a Shallow Turbid Impoundment, W85-02082 2H
Cultures, W85-02120 5B	CHAIN DECAY Contaminant Transport in Fractured Porous	CHEMICAL REDUCTION
CANTERBURY Critical Depths for Passage in Braided Rivers,	Media: Analytical Solution for a Two-Member Decay Chain in a Single Fracture, W85-02170 5B	Flux of Reduced Chemical Constituents (Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi- ment Oxygen Demand in Lake Erie,
Canterbury, New Zealand, W85-01636 2E	CHANNEL IMPROVEMENT Effects of Channel Excavation on Water-Quality	W85-02087 2H
CAPROLACTAM Fate of epsilon-Caprolactam in the Aquatic Environment,	Characteristics of the Black River and on Ground-Water Levels near Dunn, North Carolina.	CHEMISTRY OF PRECIPITATION Some Observations on the Chemical Composi- tion of Precipitation in an Industrial Area and
W85-01956 5B	W85-01924 2A	It's Use in Air Quality Assessment, W85-02129 5E
CARBAMATES Quantitative Determination of ppb Levels of Carbamate Pesticide in Water by Capillary Gas	CHANNEL MORPHOLOGY Morphology and Recent Sediments of the Lower Anastomosing Reaches of the Attawapis-	CHICAGO Potential Urban Rainfall Prediction Measure-
Chromatography, W85-01747 5A	kat River, James Bay, Ontario, Canada, W85-01734 2J	ment System, W85-01701 2B
CARBON Carbon Flow Across the Sediment-Water Inter-	CHARLESTON Computer-Assisted Water System Analysis and	CHICKAHOMINY RIVER Kepone Concentration in Juvenile Anadromous
face in Lake Vechten, The Netherlands, W85-02066 2H	Design for Charleston, S.C., W85-01907 5F	Fishes, W85-01847 5E
CARBON RADIOISOTOPES Kinetic Factors of CaCO3-Precipitation and the Partitioning of 12C and 13C. Studies at the Wa- terfalls of Guterstein and Urach (Schwabisch- Alb) (Kinetische Faktoren der CaCO3-Abschei-	CHEMICAL ANALYSES Records of Wells, Drillers' Logs, Water-Level Measurements, and Chemical Analyses of Ground Water in Chambers, Liberty, and Mont- gomery Counties, Texas, 1975-79,	CHINA Elemental Composition of Suspended Particle From the Yellow and Yangtze Rivers, W85-01703
dung und der Fraktionierung von 12C und 13C. Untersuchungen an den Wasserfallen von Guter- stein und Urach (Schwabische Alb)),	W85-01818 2F Records of Wells, Drillers' Logs, Water-Level Measurements, and Chemical Analyses of	226Ra and 228Ra in the Mixing Zones of the Per Dee River-Winyah Bay, Yangtze River and Delaware Bay Estuaries,
W85-01662 1B CARBONATES	Ground Water in Brazoria, Fort Bend, and Waller Counties, Texas, 1975-79, W85-01819 2F	W85-01912 2I Report on the Water Supply of the People'
Diagenesis and Pore-Space Evolution within Recent and Pleistocene Carbonate Units of Orote Peninsula, Guam,	Geohydrologic Data for Test Well USW G-4, Yucca Mountain Area, Nye County, Nevada,	Republic of China, W85-01995 51
W85-02027 2F	W85-02031 7C	CHLORATES Lower Detection Limits Found for Chlorin
Hydrogeologic Investigation of Agana Swamp Northern Guam, W85-02029 2F	CHEMICAL ANALYSIS Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geolog-	Dioxide Contaminants, W85-01909 51
CARCINOGENS	ical Survey for Water-Year 1982, W85-01768 7C	CHLORINATED HYDROCARBONS Mytilus galloprovincialis and Parapenaeus lon
Comparison of the Carcinogenic Risks from Fish vs. Groundwater Contamination by Organic Compounds,	Hydrogeochemical Investigation of Thermal Springs in the Black Canyon-Hoover Dam Area,	girostris as Bioindicators of Heavy Metal an Organochlorine Pollution, W85-01899 54
W85-02110 5C CARDIOVASCULAR DISEASES	Nevada and Arizona, W85-01804 2K	Dehalogenation of Three Chlorinated Hydrocar bons: Amine-Assisted Versus Metal-Chelate As
Geochemistry of Well Water and Cardiovascu- lar Diseases in Sri Lanka,	CHEMICAL COAGULATION Coagulation and Restabilization of Particulate, Macromolecular and Protected Organic Aqua-	sisted, W85-02121
W85-01674 5C	sols by Aluminum (III), W85-02105 5F	CHLORINATED PHENOLS
CARNATION CREEK Logging Impacts and Some Mechanisms that Determine the Size of Spring and Summer Pop-	CHEMICAL COMPOSITION Elemental Composition of Suspended Particles	Simultaneous Determination of Partition Coeff cients and Acidity Constants of Chlorinate Phenosand Guaiacols by Gas Chromatography
ulations of Coho Salmon Fry (Oncorhynchus kisutch) in Carnation Creek, British Columbia, W85-01919 5C	From the Yellow and Yangtze Rivers, W85-01703 2J	W85-02115 5. CHLORINATION
CATALOGS	Some Observations on the Chemical Composi- tion of Precipitation in an Industrial Area and	Determination of Organohalogenic Acids i Water Samples (Bestimmung Halogenorgan
Water Resources Division Training Catalog, W85-02032 9B	It's Use in Air Quality Assessment, W85-02129 5B	ischer Sauren in Wasserproben), W85-01663

5A

CHLORINATION

Formation of Stable Organic Chloramines During the Aqueous Chlorination of Cytosine and 5-Methylcytosine, W85-01726 5F	CHRISTCHURCH Groundwater Quality Survey of an Unsewered, Semi-Rural Area, W85-01633 5B	COAL MINING Hydrologic Responses of Stream's to Mining of the Mulberry Coal Reserves in Eastern Kansas, W85-01782 2E
Kinetics and Products of the Chlorination of Caffeine in Aqueous Solution, W85-01727 5B Formation and Removal of Mutagenic Activity	CHROMATOGRAPHY Determination of 4-Aminophenol in Water by High-Performance Liquid Chromatography with Fluorescence Detection, W85-01746 5A	COASTAL AREAS Results of Surface-water, Dyke, and Coastal Inspection – Ways Toward More Effective Inspection for the Future, W85-01874 4A
During Drinking Water Preparation, W85-01728 5F	W85-01746 5A Quantitative Determination of ppb Levels of	COASTAL WATERS
Chlorine as an Algicide in a Conventional Water Treatment Plant, W85-01749 5F	Carbamate Pesticide in Water by Capillary Gas Chromatography, W85-01747 5A	Hydrocarbons in Washington Coastal Sediments, W85-01915 5B
Chlorination of Cooling Waters and Quality of Water Resources, W85-02023 5D	Determination of Aldicarb and its Derivatives in Groundwaters by High-Performance Liquid Chromatography with UV Detection,	COATINGS Usefulness of Measuring the Corrosion Rates of Soils (Utilite des Mesures de Corrosivitie des Sols).
Effect of Chlorination on Antibiotic Resistance Profiles of Sewage-Related Bacteria, W85-02139 5D	W85-01748 5A CLADOPHORA Growth of Cladophora glomerata in a River	W85-01992 8G COBALT
HLORINE Toxicity of Chlorine to a Common Vascular	Receiving Sewage Effluent, W85-01723 5C	Adsorption of Copper, Lead and Cobalt by Activated Carbon, W85-01717 5D
Aquatic Plant, W85-01731 5C	CLAMS Annual Cycle of Kepone Residue and Lipid	COFFERDAMS Sheetpile Interlock Tension in Cellular Coffer-
Method for Total Organic Chlorine Determina- tion in Bleach Plant Recipient Waters, W85-01962 5A	Content of the Estuarine Clam, Rangia cuneata, W85-01844	dams, W85-01872 8A
HLORINE DIOXIDE Determination of Chlorine Dioxide and Chlorite	CLARIFIERS Hydrodynamic of Circular Primary Clarifiers, W85-01716 5D	COKE PLANTS Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control,
in Drinking-Water (Bestimmung von Chlor- dioxid und Chlorit im Trinkwasser), W85-01664 5F	CLAYS Accumulative Phases for Heavy Metals in	W85-01655 5D COLBITZ Execution of Socialist Business Management in
Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine Dioxide,	Limnic Sediments, W85-02077 5B	the Continuation of the Colbitz Movement (Die Durchsetzing der sozialistischen Betriebswirts-
W85-01743 5A	CLEANING Comparison of Water Mains Cleaning Tech-	chaft in Fortfuhrung der Colbitzer Bewegung), W85-01876 5F
Lower Detection Limits Found for Chlorine Dioxide Contaminants, W85-01909 5F	niques - The Experiment of Begles (Comparai- son des Techniques de Curage des Conduites d'Eau Potable - L'Experience de Begles), W85-01999 8A	COLIFORMS Influence of Physico-Chemical Factors on the Coliform Bacteria in a Closed-Lake Water
Lack of Nephrotoxicity in the Rat by Sodium Chlorite, a Possible Byproduct of Chlorine Di- oxide Disinfection in Drinking Water,	CLEAR-CUTTING Effect of Clear-Cut Silviculture on Dissolved	System, W85-01672 2H Distribution and Periodicity of Total, Faecal
W85-02119 5F CHLORITE Determination of Chlorine Dioxide and Chlorite	Ion Export and Water Yield in the Piedmont, W85-02171 5B	Coliform Bacteria in an Aquatic Ecosystem, W85-01675 5B
in Drinking-Water (Bestimmung von Chlor- dioxid und Chlorit im Trinkwasser),	CLIMATE Climatic and Anthropogenic Effects on the Sedimentation and Geochemistry of Lakes Bourget,	Beach Fecal Coliforms, W85-01711 5B
W85-01664 5F	Annecy and Leman, W85-02102 2H	Microbial Contamination of Potable Water in Distribution Systems,
Lower Detection Limits Found for Chlorine Dioxide Contaminants,	CLIMATIC DATA	W85-01796 5F Effect of Noncoliforms on Coliform Detection
W85-01909 5F CHLOROBENZENE	Water Balance and Crops in Karnataka, W85-02127 21	in Potable Groundwater: Improved Recovery with an Anserobic Membrane Filter Technique,
Removal of Volatile Organic Pollutants from Rapid Streams, W85-01738 5B	COAGULATION Coagulation and Restabilization of Particulate, Macromolecular and Protected Organic Aqua-	W85-02140 5F COLLOIDS Coagulation and Restabilization of Particulate,
CHLOROPHENOLS Chemical Derivatization Analysis of Pesticide Residues. VIII. Analysis of 15 Chlorophenols in	sols by Aluminum (III), W85-02105 5F COAL HYDROLOGY	Macromolecular and Protected Organic Aqua- sols by Aluminum (III), W85-02105 5F
Natural Water by In Situ Acetylation, W85-02113 5A	Hydrologic Responses of Stream's to Mining of the Mulberry Coal Reserves in Eastern Kansas, W85-01782 2E	COLORADO Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg-
Oxygen Depletion in Central and Eastern Lake Erie: Relationship with Bacteria, Chlorophyll, POC, and Morphometry,	COAL MINES Potential Effects of Surface Coal Mining on the	wick, and Weld Counties, Colorado, W85-01775 2F
W85-01752 2H Limnology in Reservoirs on the Colorado River,	Hydrology of the Bloomfield Coal Tract, Dawson County, Eastern Montana, W85-01791 2F	Calibration and Verification of a Rainfall-Runoff Model and a Runoff-Quality Model for Several Urban Basins in the Denver Metropolitan Area,
W85-01812 2H	Potential Effects of Surface Coal Mining on the	Colorado, W85-02044 2A
CHLOROPHYTA Response of Algal Populations to Changes in Stream Water Quality,	Hydrology of the Corral Creek Area, Hanging Woman Creek Coal Field, Southeastern Mon- tana,	Sediment Transport in the Lower Yampa River, Northwestern Colorado,
W85-01797 5C	W85-02040 5B	W85-02045 2J

COLORADO RIVER Hydrogeochemical Investigation of Thermal Springs in the Black Canyon-Hoover Dam Area,	COMPUTERS Computer Controlled Operation of an Activated Sludge Plant,	les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty- picus)),
Nevada and Arizona, W85-01804 2K	W85-01652 5D	W85-01898 5C
Limnology in Reservoirs on the Colorado River, W85-01812 2H	Computerized Distribution Records- CADD Paves the Way, W85-01902 5F	Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte- mora affinis (Copepoda),
COMBINED SEWER SYSTEMS	Microcomputer Programs for Designing Water	W85-01900 5C
Methods For Calculation of Annual and Ex- treme Overflow Events From Combined Sewer Systems,	Systems, W85-01903 8A	COPPER Adsorption of Copper, Lead and Cobalt by Activated Carbon,
W85-01699 2E	Calibrating Water System Models, W85-01904 5F	W85-01717 5D
COMBINED SEWERS Influence of Rainfall Characteristics on the Pollution Emission,	Data Bank for Waterworks and Facilities - Goals and Problem-solving Concept (Datenbank Wasserwerke und Anlagen - Aufgaben und Lo-	Study of the Copper-Complexing Compounds Released by Some Species of Cyanobacteria, W85-01725 5B
W85-01697 2E	sungskonzeption),	
COMETABOLISM Effect of Substrate Concentration and Organic	W85-01969 5F	Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte-
and Inorganic Compounds on the Occurrence and Rate of Mineralization and Cometabolism,	Instrumentation Control and Automation for Eccup Treatment Works, W85-02131 5F	mora affinis (Copepoda), W85-01900 5C
W85-02132 5B		CORBICULA
COMMUNITY INVOLVEMENT Development and Field Testing of a Methodology for Assessing Community Readiness for	COMPUTOR PROGRAMS True Location and Orientation of Fractures Logged with the Acoustic Televiewer (Includ-	Occurrence of the Asiatic Clam Corbicula flu- minea in the Maumee River and Western Lake Erie,
Self-Help in the Installation, Maintenance and Repair of Water Supply and Sanitation Facili-	ing Programs to Correct Fracture Orientation), W85-01780 2F	W85-01753 SC
ties,	CONCRETE CONSTRUCTION	CORIO BAY
W85-01980 7C COMPETITION	Concrete in Hydraulic Engineering for a Better Environment (Beton im Wasserbau fur bessere	Aromatic Hydrocarbons in Waters of Port Phil- lip Bay and the Yarra River Estuary, W85-01644 5B
Competition Versus Optimal Control in Ground- water Pumping when Demand is Nonlinear,	Umwelt), W85-01861 8F	CORROSION
W85-02141 4B	CONCRETE TESTING	Corrosion Behaviour of Cast Iron Pipes,
COMPOSTING	Measurement of Concrete Permeability,	W85-01994 8G
Waste Management Scenarios for Minnesota's Twin Cities, W85-01867 5E	W85-01714 8F CONJUNCTIVE USE	New Materials in Pipe Networks - Special Consideration of Internal Coatings,
COMPUTER MODELS	LP Embedded Simulation Model for Conjunc- tive Use Management Optimization,	W85-01997 2G
Pump Station Design: The Benefits of Computer Modeling,	W85-01801 4B CONNECTICUT	CORROSION CONTROL Corrosion and Protection of Pipes in Develop- ing Countries,
W85-01905 8C	Epilimnetic Nutrient Loading by Metalimnetic	W85-01991 8A
Computer Modeling in Water System Planning and Design, W85-01906 5F	Erosion and Resultant Algal Responses in Lake Waramaug, Connecticut, W85-02093 2H	CORROSIVE SOILS Usefulness of Measuring the Corrosion Rates of
Computer-Assisted Water System Analysis and Design for Charleston, S.C.,	CONSTRUCTION Sheetpile Interlock Tension in Cellular Coffer-	Soils (Utilite des Mesures de Corrosivitie des Sols), W85-01992 8G
W85-01907 5F	dams,	
Integrated Methodology for Instream Flow Strategies,	W85-01872 8A Friedrichroda Wastewater Treatment Facility -	COST-BENEFIT ANALYSIS Cost and Benefits of Drinking Water Treatment, W85-01649 5F
W85-01951 5B	Results of an Experiment (Klaranlage Friedrich- roda - Ergebnisse eines Experiments),	COSTS
Calculation of Melt-water Discharge from the	W85-01884 5D	Reduction of the Use of Materials with the Aid
Snow Cover in Catchment Areas in the Mittel- gebirge Mountains (Berechnung der Schmelz- wasserabgabe aus der Schneedecke in Einzugs-	CONTROL SYSTEMS Case for Automated Water Management,	of Science and Technology at the Hydrotechno- logy and Water-Management-Planning Combine (Senkung des Produktionsverbrauchs mit Hilfe
gebieten des Mittelgebirges),	W85-02130 6A	von Wissenschaft und Technik im VEB Kom-
W85-01972 2C	CONVECTION	binat Wassertechnik un Projektierung Wasser- wirtschaft),
Hydrogeology of Well-Field Areas near Tampa, Florida, Phase 2Development and Documenta- tion of a Quasi-Three-Dimensional Finite-Differ-	Flux-Averaged and Volume-Averaged Concen- trations in Continuum Approaches to Solute Transport,	W85-01968 5D
ence Model for Simulation of Steady-State Ground-Water Flow,	W85-02153 2F	CROP PRODUCTION Water Balance and Crops in Karnataka, W85-02127 21
W85-02052 2F	Eulerian-Lagrangian Solution of the Convec- tion-Dispersion Equation in Natural Coordi-	
Real Time Irrigation Scheduling via 'Reaching' Dynamic Programming, W85-02155 3F	nates, W85-02162 1B	CROP RESPONSE Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains,
	COOLING TOWERS	W85-01952 3F
COMPUTER PROGRAMS Computer Program and Data Listing for Two-	Chlorination of Cooling Waters and Quality of Water Resources,	CROP YIELD
Dimensional Ground-Water Model for Laramie County, Wyoming.	W85-02023 5D	Yield and Quality of Cotton Grown with Wastewater,
W85-01787 7C	COPEPODS	W85-01869 5D
Integrated Methodology for Instream Flow	Impact of Domestic Sewage Pollution on Enzy- matic Activities of Two Planktonic Copepods	Agricultural Droughts at Peddapuram, East Go-
Strategies, W85-01951 5B	(Acartia clausi and Centropages typicus) (Impact d'une Pollution d'Origine Urbaine sur	davari District, Andhra Pradesh, W85-02126 2I

SUBJECT INDEX

CULVERT DESIGN

CULVERT DESIGN	DATA COLLECTIONS	DELAWARE BAY
Prediction of Peak Flows for Culvert Design on	Quality-Assurance Data for Routine Water	226Ra and 228Ra in the Mixing Zones of the Pee
Small Watersheds in Oregon,	Analysis in the Laboratories of the U.S. Geolog-	Dee River-Winyah Bay, Yangtze River and
W85-01820 4A	ical Survey for Water-Year 1982,	Delaware Bay Estuaries,
CULVERTS	W85-01768 7C	W85-01912 2L
Prediction of Peak Flows for Culvert Design on	Water Resources Data, Kentucky, Water Year	DELAWARE RIVER
Small Watersheds in Oregon, W85-01820 4A	1982,	Fluxes of Heavy Metals in Delaware River
W83-01620 4A	W85-01923 2E	Freshwater Tidal Wetlands,
CUMBERLAND RIVER	Water Resources Data, Iowa, Water Year 1982,	W85-01805 5B
Changes in the Naiad Fauna of the Cumberland	W85-01931 2E	DELAWARE RIVER ESTUARY
River below Lake Cumberland in Central Ken- tucky.		Phosphorus Distribution in Sediments of the
W85-01921 6G	Water Resources Data, Kansas Water Year	Delaware River Estuary,
	1982, W85-01932 2E	W85-01843 2L
CYANOPHYTA Study of the Copper-Complexing Compounds	W85-01932 2E	DENMARK
Released by Some Species of Cyanobacteria,	Water Resources Data, New Hampshire and	Staged Approach to Application of Rainfall
W85-01725 5B	Vermont, Water Year 1982,	Data to Urban Runoff Calculations,
CHARLES OF MAINTENANCE	W85-01933 2E	W85-01694 2E
CYCLING NUTRIENTS Modeling Estuarine Nutrient Geochemistry in a	Water Resources Data, Arkansas, Water Year	Control of Metal Contaminants in Drinking
Simple System,	1982,	Water in Denmark,
W85-01702 2L	W85-01934 2E	W85-01993 5F
Carbon Flow Across the Sediment-Water Inter-	W. P. D. M. L.	
face in Lake Vechten, The Netherlands,	Water Resources Data, Massachusetts and Rhode Island, Water Year 1982,	Diurnal Variation in the Oxygen Uptake of
W85-02066 2H	W85-01935 2E	River Sediments in Vitro by Use of Continuous Flow-Through Systems,
	W65-01935	W85-02069 2E
CYTOSINE Formation of Stable Organic Chloramines	Water Resources Data, North Dakota, Water	W 05-02009
During the Aqueous Chlorination of Cytosine	Year 1982,	DEPTH-AREA-DURATION ANALYSIS
and 5-Methylcytosine,	W85-01936 2E	Depth-Duration Models of Short Time Incre-
W85-01726 5F	Water Resources Data, South Carolina, Water	ment Rainfall,
CZECHOSLOVAKIA	Year 1982.	W85-01683 2B
Synthetic Design Storm and its Relation to In-	W85-01937 2E	DESALINATION
tensity-Duration Frequency Curves,	W. B. B. G. I W. W.	Evalution of Hollow Fiber Ultrafiltration as a
W85-01679 2B	Water Resources Data, Georgia, Water Year 1982.	Pretreatment for Reverse Osmosis Desalination
DAM CONSTRUCTION	W85-01938 2E	of Seawater,
Construction of the Alicura Hydroelectric Facil-	1103-01330	W85-01830 3A
ity in Argentina (Der Bau der Wasserkraftanlage	Water Resources Data, Alabama, Water Year	DESIGN
Alicura in Argentinien),	1982,	Microcomputer Programs for Designing Water
W85-01862 8A	W85-01939 2E	Systems,
Progress in Rockfill Dams,	Data for Ground-Water Studies of the San Juan	W85-01903 8A
W85-01870 8A	Basin, New Mexico (1982-83),	Pump Station Design: The Benefits of Computer
Earth Foundation Treatment at Jebba Dam Site,	W85-02034 7C	Modeling,
W85-01871 8D	DATA PROCESSING	W85-01905 8C
	Review of Rainfall Data Application for Design	Comment Madelland Water Comment
DAM EFFECTS Changes in the Naiad Fauna of the Cumberland	and Analysis,	Computer Modeling in Water System Planning and Design,
River below Lake Cumberland in Central Ken-	W85-01677 2B	W85-01906 5F
tucky,	Public Dr. Brands Bridges B	
W85-01921 6G	Evolving Data Processing Environment For Computational Hydraulics Systems,	DESIGN CRITERIA
DAM KEEPERS	W85-01709 7C	Mixing Effects in UV Disinfection,
Tasks of the Dam Keeper (Les Taches du Gar-	,,,	W85-01659 5D
dien de Barrage),	Rationalization of Central Planning in Water	Design of Armour Systems for the Protection of
W85-01859 4A	Management Through the Introduction of EDP	Rubble Mound Breakwaters,
DAMAGE	(Rationalizierung der zentralen Planung in der Wasserwirtschaft durch Einsatz der EDV),	W85-01707 2J
Tort Recovery of Acid Rain Damages in the	W85-01879 7C	DESIGN FLOODS
United States - Observations on Plaintiff's Prima		Time Patterns of Rainfall For Estimating Design
Facie Case,	DECOMPOSITION	Floods on a Frequency Basis,
W85-01667 6E	Decomposition of Wild Rice (Zizania aquatica)	W85-01687 2B
DAPHNIA	Straw in Two Natural Lakes of Northwestern Ontario.	DESIGN INFLOW INTENSITY
Trophic Ecology of Fish Rearing Ponds,	W85-01647 2H	Design Inflow Intensity and Design Inflow Pro-
W85-01833 2H		files For Storm Sewers,
Toxicity of Organic Mixtures Saturated in Water	Relative Contributions of Bacteria and Fungi to	W85-01692 2E
to Daphnia magna. Effect of Compositional	Rates of Degradation of Lignocellulosic Detri- tus in Salt-Marsh Sediments,	
Changes,	W85-02138 2L	Design Inflow Intensity and Design Inflow Pro-
W85-01953 5C		Design Inflow Intensity and Design Inflow Pro- files For Storm Sewers,
DARCY'S LAW	DEGRADATION	W85-01692 2E
Darcy's Flow with Variable Permeability: A	Fate of epsilon-Caprolactam in the Aquatic En-	
Boundary Integral Solution,	vironment,	DESIGN STORMS
W85-02165 2F	W85-01956 5B	Design Storm for a Tropical Location with Lim- ited Data,
DART LAKE	DEHALOGENATION	W85-01678 2B
Short-Term Changes in the Base Neutralizing	Dehalogenation of Three Chlorinated Hydrocar-	
Capacity of an Acid Adirondack Lake, New	bons: Amine-Assisted Versus Metal-Chelate As-	Synthetic Design Storm and its Relation to In-
York, W85-01917 5B	sisted, W85-02121 5F	tensity-Duration Frequency Curves, W85-01679 2B
JB	of only	W85-01679 2B

Rainfall Events as Paths of a Stochastic Process: Problems of Design Storm Analysis, W85-01684 2B	Mixing Effects in UV Disinfection, W85-01659 5D	DOLOMITES Classification and Description of Dolomitic Fabrics of Books from the Floriday April V. S. A.
Temporal Distribution of Design Storm Rainfall,	Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine	rics of Rocks from the Floridan Aquifer, U.S.A., W85-01733 2F
W85-01688 2B	Dioxide,	DRAINAGE DITCHES
Evaluation of Urban Design Storm Sensitivity, W85-01693 2B	W85-01743 5A Ultraviolet Disinfection of Water,	Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near the East Unit, Indiana Dunes National Lake-
DETENTION RESERVOIRS	W85-02020 5D	shore, Indiana, 1982.
Rainfall Data For the Design of Detention	DICOPPORATOR	W85-01948 4A
Basins,	DISPERSION Flux-Averaged and Volume-Averaged Concen-	DRAINAGE CUCTEME
W85-01695 2E	trations in Continuum Approaches to Solute	DRAINAGE SYSTEMS Evaluation of Urban Design Storm Sensitivity,
DETERGENTS	Transport,	W85-01693 2B
Identification of Nonionic Detergents by GC/	W85-02153 2F	
CI-MS: I. A Complementary Method or an Attractive Alternative to GC/EI-MS and Other	Eulerian-Lagrangian Solution of the Convec- tion-Dispersion Equation in Natural Coordi-	Drainage Basins in Duval County, Florida, W85-02046 7C
Methods, W85-01955 5A	nates, W85-02162 1B	Sediment Concentrations from Intensively Pre-
DEVELOPING COUNTRIES	W 83-02102	pared Wetland Sites, W85-02112 4C
Development and Field Testing of a Methodolo-	DISSOLVED NUTRIENTS	a Company of the comp
gy for Assessing Community Readiness for	Influence of Within-Stream Disturbance on Dis-	DREDGING
Self-Help in the Installation, Maintenance and Repair of Water Supply and Sanitation Facili-	solved Nutrient Levels During Spates, W85-02089 2E	Lake Trehorningen Restoration Project. Changes in Water Quality after Sediment
ties, W85-01980 7C	DISSOLVED ORGANIC COMPOUNDS	Dredging, W85-02097 5G
	Chemical Study of the Interstitial Water Dis-	W85-02097 5G
Appropriate Water Supply Technology for De-	solved Organic Matter and Gases in Lake Erie,	DRILLING MUDS
veloping Countries, W85-01981 5F	Cleveland Harbor, and Hamilton Harbour Bottom Sediments-Composition and Fluxes to	Responses of Developing Estuarine Macro-
	Overlying Waters,	benthic Communities to Drilling Muds, W85-01845 5C
Practical Water Treatment for Communities in	W85-01814 5B	W 63-01643
Developing Countries, W85-01983 5F	DISSOLVED OXYGEN	DRINKING WATER
Water Decade (La Decennie de l'Eau),	Effect of Low Dissolved Oxygen Concentration	Cost and Benefits of Drinking Water Treatment, W85-01649 5F
W85-01984 6B	on Effluent Turbidity, W85-01653 5D	Determination of Chlorine Dioxide and Chlorite
First Experiences with a Women-Specific		in Drinking-Water (Bestimmung von Chlor-
Project for the Water Decade, W85-02004 5F	Stochastic Model for BOD and DO in Streams When the Velocity is Random and Distance-	dioxid und Chlorit im Trinkwasser), W85-01664 5F
Drinking Water in Developing Countries - The	Dependent, W85-01676 5B	Formation and Removal of Mutagenic Activity
Minimum Treatment Philosophy. A Case Study, W85-02018 3B	Water Quality of Lake Arlington on Village	During Drinking Water Preparation, W85-01728 5F
Irrigated Agricultural Expansion Planning in	Creek, North-Central Texas, 1973 to 1981, W85-02042 2H	Determination of Oxidants Formed upon the
Developing Countries: Investment Scheduling	Availability of Dissalved Orygon in Intentitial	Disinfection of Drinking Water with Chlorine
Incorporating Drainage Water Reuse, W85-02142 3F	Availability of Dissolved Oxygen in Interstitial Waters of a Sandy Creek,	Dioxide, W85-01743 5A
Industral Applement Francisco Discolor in	W85-02103 2E	
Irrigated Agricultural Expansion Planning in Developing Countries: Income Redistribution	Dependence of Hypolimnetic Oxygen Consump-	Microbial Contamination of Potable Water in
Objective,	tion on Ambient Oxygen Concentration: Fact or	Distribution Systems, W85-01796 5F
W85-02143 3F	Artifact, W85-02149 2H	Nice on the French Birless, the Birtheless of
Irrigated Agricultural Expansion Planning in	W83-02149 2H	Nice on the French Riviera - the Birthplace of Drinking Water Treatment with Ozone (Nice,
Developing Countries: Resilient System Design, W85-02144 6A	DISSOLVED SOLIDS	sur la Riviera Française - Berceau du Traitement
W85-02144 6A	Transport of Dissolved Organic Carbon through a Major Creek of the North Inlet Ecosystem,	de l'Eau par l'Ozone),
DEVIS RESERVOIR	W85-01766 2L	W85-01988 5F
Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-		General Strategy for Security in Water Supply,
ame,	Statistical Analysis and Evaluation of Water- Quality Data for Selected Streams in the Coal	W85-01990 5G
W85-01764 6G	Area of East-Central Montana,	Control of Metal Contaminants in Drinking
DIAGENESIS	W85-01770 5B	Water in Denmark,
Diagenesis and Pore-Space Evolution within	Fluoride, Nitrate, and Dissolved-Solids Concen-	W85-01993 5F
Recent and Pleistocene Carbonate Units of Orote Peninsula, Guam,	trations in Ground Waters of Washington,	Report on the Water Supply of the People's
W85-02027 2F	W85-01828 2F	Republic of China,
	Singlet Oxygen in Surface Waters - Part II:	W85-01995 5F
DIFFUSION Wind Induced Diffusion in a Shallow Lake, A	Quantum Yields of Its Production by Some Nat-	Remote Monitoring and Optimisation of Pump
Case Study, W85-01763 2H	ural Humic Materials as a Function of Wave- length,	ing at the Syndicat des Eaux of La Haute-Loue (Telesurveillance et Optimisation du Pompage
	W85-01965 2K	du Syndicat des Eaux de La Haute-Loue),
DISCHARGE HYDROGRAPH Exploratory Drilling and Aquifer Testing at the	Water Quality of Lake Arlington on Village	W85-02005 5F
Kipahulu District Haleakala National Park,	Creek, North-Central Texas, 1973 to 1981,	Review of the Water Supply in the Sovie
Maui, Hawaii,	W85-02042 2H	
W85-01776 2F	DOLLARD	
DISINFECTION	Use of a Model to Assess Factors Affecting the	
Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D	Oxygen Balance in the Water of the Dollard, W85-01839 2L	
	11 03 01037 412	

SUBJECT INDEX

DRINKING WATER

Potable Water Treatment in Tropical Countries: Recent Experiences and Some Technological Trends,	ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi- tat der landwirtschaftlichen und wasserwirts-	Effects of the Herbicide Atrazine on Adenine Nucleotide Levels in Zostera marina L. (Eel-
W85-02022 5F	chaftlichen Produktion in Trinkwasser-Einzugs- gebieten),	grass), W85-01888 5C
Chlorination of Cooling Waters and Quality of	W85-01883 4D	
Water Resources, W85-02023 5D	Friedrichroda Wastewater Treatment Facility - Results of an Experiment (Klaranlage Friedrich-	EFFLUENTS Effect of Low Dissolved Oxygen Concentration on Effluent Turbidity,
Lack of Nephrotoxicity in the Rat by Sodium Chlorite, a Possible Byproduct of Chlorine Di-	roda - Ergebnisse eines Experiments), W85-01884 SD	W85-01653 5D
oxide Disinfection in Drinking Water, W85-02119 5F	Reduction of the Use of Materials with the Aid of Science and Technology at the Hydrotechno-	Enteric Virus Levels in Wastewater Effluents and Surface Waters in the Severn Trent Water
Association of Metal Tolerance with Multiple Antibiotic Resistance of Bacteria Isolated from	logy and Water-Management-Planning Combine (Senkung des Produktionsverbrauchs mit Hilfe	Authority 1979-1981, W85-01718 5B
Drinking Water, W85-02133 5F	von Wissenschaft und Technik im VEB Kom- binat Wassertechnik un Projektierung Wasser-	Water Supply of Alexandria Egypt,
Detection of Enteric Viruses in Treated Drinking Water,	wirtschaft), W85-01968 5D	W85-01985 5F
W85-02136 5F	Data Bank for Waterworks and Facilities -	Effects of Sedimentation on the Storage Capacity of the High Aswan Dam Reservoir,
Simultaneous Concentration of Four Enterovir- uses from Tap, Waste, and Natural Waters,	Goals and Problem-solving Concept (Datenbank Wasserwerke und Anlagen - Aufgaben und Lo-	W85-02101 4A EL PASO
W85-02137 5A	sungskonzeption), W85-01969 5F	Conventional Water Process Costs Studied,
DROUGHT Drought in Southeastern United States,	Suggestion for Year-Round Wastewater Utiliza-	W85-01706 5D ELBE
W85-01642 2B Drought Effect on High-Altitude Forests, Rua-	tion in the Forestry Industry (Vorschlag zur ganzjahrigen Abwasserverwertung in der	Forecasting of Water Level and Discharge of
hine Range, North Island, New Zealand, W85-01886 2A	Forstwirtschaft), W85-01971 5D	the Elbe with the Aid of Fuzzy Modelling (Vor- hersage von Wasserstand und Durchfluss für die Elbe mit Hilfe einer unscharfen Modellierung),
Phenology and Water Relations of Three Plant	Calculation of Melt-water Discharge from the Snow Cover in Catchment Areas in the Mittel-	W85-01973 2E
Life Forms in a Dry Tree-Line Meadow, W85-01892 2I	gebirge Mountains (Berechnung der Schmelz- wasserabgabe aus der Schneedecke in Einzugs-	ELBE ESTUARY River Elbe: Processes Affecting the Behaviour
Agricultural Droughts at Peddapuram, East Go-	gebieten des Mittelgebirges), W85-01972 2C	of Metals and Organochlorines During Estuarine Mixing,
davari District, Andhra Pradesh, W85-02126 2I	Forecasting of Water Level and Discharge of	W85-01836 5B
DUPUIT-FORCHHEIMER MODELS	the Elbe with the Aid of Fuzzy Modelling (Vor- hersage von Wasserstand und Durchfluss fur die	ELECTRIC POWER COSTS Economics of Acid Rain: An Invisible Hand of
Three-Dimensional Streamlines in Dupuit- Forchheimer Models, W85-02148 2F	Elbe mit Hilfe einer unscharfen Modellierung), W85-01973 2E	Control, W85-01666 5C
DYKES	Observations from the Test Operation of an Ion-	ELECTRIC POWERPLANTS
Results of Surface-water, Dyke, and Coastal In- spection - Ways Toward More Effective In-	exchange Facility for Nitrate Removal in Drink- ing-water Treatment (Erfahrungen aus dem Er-	Economics of Acid Rain: An Invisible Hand of Control,
spection for the Future, W85-01874 4A	probengsbetrieb einer Ionenaustauscheranlage zur Nitratelimination in der Trinkwasseraufber-	W85-01666 5C
EAST GERMANY	eitung), W85-01974 5F	Data for Ground-Water Test Hole near Nico-
Results of Surface-water, Dyke, and Coastal In- spection - Ways Toward More Effective In-	ECOLOGICAL EFFECTS	laus, Central Valley Aquifer Project, California, W85-01929 7C
spection for the Future, W85-01874 4A	Impact of an Oil Field Effluent on Microbial Activities in a Wyoming River,	Data for Ground-Water Test Hole Near Butte
Execution of Socialist Business Management in	W85-01640 5C	City, Central Valley Aquifer Project, California, W85-01941 7C
the Continuation of the Colbitz Movement (Die Durchsetzing der sozialistischen Betriebswirts-	ECONOMIC ANALYSIS Economics of Acid Rain: An Invisible Hand of	ELECTRODES
chaft in Fortfuhrung der Colbitzer Bewegung), W85-01876 5F	Control, W85-01666 5C	Evaluation of Electrode Methods for Determin- ing Total Residual Chlorine in Various Water Matrices,
Construction of Rationalization Equipment at	ECONOMIC ASPECTS	W85-02123 7B
the Rostock Water-Supply and Wastewater- treatment Facility (Rationalisierungsmittelbau	Conventional Water Process Costs Studied, W85-01706 5D	ELECTRODIALYSIS State-of-the-Art of the Electrodialysis Reversal
im VEB Wasserversorgung und Abwasserbe- handlung Restock), W85-01877 5F	ECONOMIC JUSTIFICATION Evaluation of the Visibility Criterion of the Mas-	(EDR) Process, W85-01851 5D
Rationalization of Central Planning in Water	sachusetts Sanitary Code for Swimming in Natu- ral Waters.	ELECTROPLATING
Management Through the Introduction of EDP (Rationalizierung der zentralen Planung in der	W85-01800 6E	Reduction of Costs and Liability Risks in Elec- troplating Wastewater Treatment,
Wasserwirtschaft durch Einsatz der EDV),	ECOSYSTEMS Acid Precipitation and Scientific Uncertainty	W85-01852 5D
W85-01879 7C Results and Experience of the Greiz Water-	Problems in Probability,	EMS-DOLLARD ESTUARY One-Dimensional Mixing and Flushing Model of
Supply District in the Field of Rational Water Use (Ergebnisse und Erfahrungen des Versor-	W85-01665 5C EDUCATION	the Ems-Dollard Estuary: Calculation of Time Scales at Different River Discharges,
gungsbereichs Greiz bei der rationellen Wasser-	Training Programmes in Federal Systems of	W85-01838 2L
verwendung), W85-01880 3D	Government, W85-01989 6F	EMS ESTUARY
Ensuring a High Level of Effectiveness and Intensity of Agricultural and Water-Manage-	Water Resources Division Training Catalog,	Use of a Model to Assess Factors Affecting the Oxygen Balance in the Water of the Dollard W85.01839

ENERGY	ulations of Coho Salmon Fry (Oncorhynchus	ESTUARIES
Energy Studies of Wastewater-Treatment Facili- ties as a Basis for Optima! Energy Use (Ener-	kisutch) in Carnation Creek, British Columbia, W85-01919 5C	River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine
giestudien von Abwasserbehandlingsanlagen als Grundlage fur den optimalen Energieeinsatz),	Changes in the Naiad Fauna of the Cumberland	Mixing, W85-01837 5B
W85-01878 5D	River below Lake Cumberland in Central Ken- tucky.	One-Dimensional Mixing and Flushing Model of
ENERGY RECOVERY Intensification of Wastewater and Sludge Treat-	W85-01921 6G	the Ems-Dollard Estuary: Calculation of Time Scales at Different River Discharges,
ment Processes Through Utilization of the	Climatic and Anthropogenic Effects on the Sedi-	W85-01838 2L
Energy Potential of Wastewater (Intensivierung der Abwasser-und Schlammbehandlingsprozesse durch nutzung des Eigenenergiepotenitals der	mentation and Geochemistry of Lakes Bourget, Annecy and Leman, W85-02102 2H	Use of a Model to Assess Factors Affecting the Oxygen Balance in the Water of the Dollard,
Abwasser), W85-01970 5D	ENVIRONMENTAL IMPACT STATEMENT	W85-01839 2L
ENGLAND	Commentary on Environmental Impact Assess- ment for Large Projects Affecting Lakes and	Effects of Ammonium Effluents on Planktonic Primary Production and Decomposition in a
Enteric Virus Levels in Wastewater Effluents and Surface Waters in the Severn Trent Water	Streams, W85-01920 6G	Coastal Brackish Water Environment. I. Interre- lations Between Abiotic and Biotic Components
Authority 1979-1981, W85-01718 5B		of the Planktonic Ecosystem, W85-01840 5C
	ENVIRONMENTAL PROTECTION General Strategy for Security in Water Supply,	
Modeling Algal Behaviour in the River Thames, W85-01720 5G	W85-01990 5G	Behaviour of Polycyclic Aromatic Hydrocar- bons in the Exe Estuary, Devon, W85-01841 5B
Growth of Cladophora glomerata in a River	ENZYMES Impact of Domestic Sewage Pollution on Enzy-	Statistical Analysis of Estuarine Profiles: II Ap-
Receiving Sewage Effluent, W85-01723 5C	matic Activities of Two Planktonic Copepods (Acartia clausi and Centropages typicus)	plication to Arsenic in the Tamar Estuary (S.W. England),
Statistical Analysis of Estuarine Profiles: II Ap-	(Impact d'une Pollution d'Origine Urbaine sur	W85-01914 5B
plication to Arsenic in the Tamar Estuary (S.W. England),	les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty-	Benthic Phosphorus Regeneration in the Poto-
W85-01914 5B	picus)), W85-01898 5C	mac River Estuary, W85-02088 2L
Automated Sensor Systems for Water Resource Pollution Warning and Treatment Process Con-	Bioavailability of Pb and Zn from Mine Tailings	ESTUARINE ENVIRONMENT
trol, W85-02010 5F	as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in	Modeling Estuarine Nutrient Geochemistry in a Simple System,
Automated Water Laboratory - What Benefit to	Suckers (Pisces: Catostomidae),	W85-01702 2L
the Consumer,	W85-01918 5A	Responses of Developing Estuarine Macro- benthic Communities to Drilling Muds,
W85-02011 7B	Enzymatic Hydrolysis Tests on an Industrial Effluent Prior to its Biological Purification	W85-01845 5C
Hydrocarbon Accumulation in Freshwater Sedi- ments of an Urban Catchment, W85-02078 5B	(Essais d'Hydrolyse Enzymatique d'un Effluent Industriel avant son Epuration Biologique),	Trophic Response of Fishes to Habitat Variabili- ty in Coastal Seagrass Systems,
ENTEROVIRUSES	W85-01975 5D	W85-01890 2L
Enteric Virus Levels in Wastewater Effluents	Potential Use of Enzymes as Catalysts in Drink- ing Water for the Oxidation of Taste Causing	226Ra and 228Ra in the Mixing Zones of the Pee Dee River-Winyah Bay, Yangtze River and
and Surface Waters in the Severn Trent Water Authority 1979-1981,	Substances, W85-02021 5F	Delaware Bay Estuaries,
W85-01718 5B		W85-01912 2L
Detection of Enteric Viruses in Treated Drink-	EPILIMNION Epilimnetic Nutrient Loading by Metalimnetic	Behavior of Organically-Bound Iron in Seawater of Estuaries,
ing Water, W85-02136 5F	Erosion and Resultant Algal Responses in Lake Waramaug, Connecticut,	W85-01913 2L
Simultaneous Concentration of Four Enterovir-	W85-02093 2H	ETHIOPIA
uses from Tap, Waste, and Natural Waters, W85-02137 5A	EROSION	Appropriate Water Supply Technology for De- veloping Countries,
	Forests, Floods, and Erosion: A Watershed Ex-	W85-01981 5F
ENTRAINMENT Entrainment, Deposition, and Transport of Fine-	periment in the Southeastern Piedmont, W85-01705 2J	EULERIAN-LAGRANGIAN METHOD
Grained Sediments in Lakes, W85-02055 2J	Erosion and Sedimentation Chronology of	Eulerian-Lagrangian Solution of the Convec- tion-Dispersion Equation in Natural Coordi-
ENVIRONMENTAL EFFECTS	Three Watersheds in Maryland, W85-01835 2J	nates, W85-02162 1B
Acid Precipitation and Scientific Uncertainty Problems in Probability,	Application of Remote-Sensing Techniques to	EUROPEAN ECONOMIC COMMUNITY
W85-01665 5C	Hydrologic Studies in Selected Coal-Mined	Water Decade (La Decennie de l'Eau), W85-01984 6B
Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-	Areas of Southeastern Kansas, W85-01947 5B	EUTROPHIC LAKES
ame, W85-01764 6G	EROSION CONTROL Erosion Control at High Altitudes (Erosionsbe-	Dynamic Phosphate Budget Model for a Eutro- phic Lake,
Changes in the Fish Fauna of the Former Gre-	kampfung im Hochgebirge), W85-01863 4D	W85-02072 2H
velingen Estuary, before and after the Closure in 1971,	EROSION RATES	EUTROPHICATION Analysis of Pollutant Enhanced Bacterial Blue-
W85-01765 6G	Rainfall Energy From Drop Size Data,	Green Algal Interrelationships Potentiating Sur- face Water Contamination by Noxious Blue-
Man-Made Structures on Marine Sediments: Ef- fects on Adjacent Benthic Communities.	W85-01696 2B	Green Algal Blooms, W85-01803 5C
W85-01895 6G	ESTIMATING Maximum Likelihood Estimates for the Param-	Development of the Condition of the Baldegger-
Logging Impacts and Some Mechanisms that Determine the Size of Spring and Summer Pop-	eters of Mixture Distributions, W85-02156 2E	see (1900 to 1980) and the Effect of Intralake Procedures (Die Zustandsentwicklung dis Bal-

SUBJECT INDEX

EUTROPHICATION

deggersees (1900 bis 1980) und die Auswirkung von seeinternen Massnahmen),	Adsorption of Surfactants on Sediments, W85-01960 5A	Acute Toxicity of Kepone to Selected Freshwater Fishes,
W85-01865 5C Impact of Acidification and Eutrophication on	Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal	W85-01846 5C Kepone Concentration in Juvenile Anadromous
Macrophyte Communites in Soft Waters. II. Experimental Studies,	and Regional Variations, W85-02091 5B	Fishes, W85-01847 5B
W85-01889 5C	Effect of Substrate Concentration and Organic	Trophic Response of Fishes to Habitat Variabili-
Deepwater Sediments and Trophic Conditions in Florida Lakes,	and Inorganic Compounds on the Occurrence and Rate of Mineralization and Cometabolism,	ty in Coastal Seagrass Systems, W85-01890 2L
W85-02099 2H	W85-02132 5B	
EVALUATION	FATHEAD MINNOWS Laboratory Assessment of the Toxicity of Urban	Factors Structuring Fish Assemblages Along a Bog Lake Successional Gradient,
Evaluation of the Visibility Criterion of the Mas- sachusetts Sanitary Code for Swimming in Natu-	Runoff on the Fathead Minnow (Pimephales promelas),	W85-01891 2H
ral Waters, W85-01800 6E	W85-02124 5C	Pesticide and PCB Levels in Fish from Alberta (Canada).
EVAPORATION	FEDERAL COMMON LAW	W85-01954 5A
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New	Acid Rain and Federal Common Law, W85-01668 6E	Analysis of Aquatic Toxicity Data: Water Solu-
Mexico, Phase II,	FEDERAL-STATE COOPERATION	bility and Acute LC50 Fish Data, W85-01966 5C
W85-01817 3F	Highlights of the 1983 Federal-State Coopera- tive Water Resources Program,	Comparison of the Carcinogenic Risks from Fish
Water Hyacinth Canopy and Pan Evaporation, W85-02128 4A	W85-01829 9D	vs. Groundwater Contamination by Organic
EVAPOTRANSPIRATION	FERROUS IRON Flux of Reduced Chemical Constituents	Compounds, W85-02110 5C
Water-Use Production Functions of Selected	(Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-	FISH MANAGEMENT
Agronomic Crops in Northwestern New Mexico, Phase II.	ment Oxygen Demand in Lake Erie, W85-02087 2H	Evaluation of Fisherman Benefits Stemming
W85-01817 3F	FIREROPTICS	from Special Use Fishery Management Pro- grams,
Developing the Resource Potential of a Shallow Water Table.	Improved Operational Control of Sedimentation	W85-01831 6B
W85-01832 3B	Facilities Through the Use of Fiberoptic Sensors (Verbesserte Betriebskontrolle von Sedimenta-	FISH YIELD
Hydrogeology of Well-Field Areas near Tampa,	tionsanlagen durch Nutzung faseroptischer Sen- soren),	Trophic Ecology of Fish Rearing Ponds, W85-01833 2H
Florida, Phase 2-Development and Documenta- tion of a Quasi-Three-Dimensional Finite-Differ-	W85-01882 5D	
ence Model for Simulation of Steady-State	FILTER FIELDS	FLATFISH Hepatic Mixed-Function Oxidases in California
Ground-Water Flow, W85-02052 2F	Disposal of Household Wastewater in Soils of High Stone Content (1981-1983),	Flatfishes are Increased in Contaminated Envi- ronments and by Oil and PCB Ingestion,
Water Hyacinth Canopy and Pan Evaporation,	W85-01815 5D	W85-01894 5A
W85-02128 4A	FILTER MEDIA Wastewater Treatment with Aerated Submerged	FLOCCULATION
EVAPOTRANSPIRATION CONTROL	Biological Filters,	Contact Flocculation-Filtration of Humic Sub- stances,
Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains,	W85-01736 5D	W85-01722 5D
W85-01952 3F	FILTRATION Contact Flocculation-Filtration of Humic Sub-	Flocculation Model Testing: Particle Sizes in a
PALLOUT	stances,	Softening Plant, W85-01908 5F
Some Observations on the Chemical Composi- tion of Precipitation in an Industrial Area and		
It's Use in Air Quality Assessment, W85-02129 5B	Ozonation and Activated Carbon Filtration: a Critical Evaluation,	FLOOD DISCHARGE Flood Potential of Fortymile Wash and its Prin-
FATE OF POLLUTANTS	W85-02019 5F	cipal Southwestern Tributaries, Nevada Test
Heavy Metals in the Lower Mississippi River,	Instrumentation Control and Automation for Eccup Treatment Works,	Site, Southern Nevada, W85-02037 2E
W85-01744 5B	W85-02131 5F	FLOOD FREQUENCIES
River Elbe: Processes Affecting the Behaviour of Metals and Organochlorines During Estuarine	FINANCING	Prediction of Peak Flows for Culvert Design or
Mixing,	Water Decade (La Decennie de l'Eau), W85-01984 6B	Small Watersheds in Oregon, W85-01820 4A
W85-01836 5B	FINLAND	FLOOD FREQUENCY
River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine	Effects of Ammonium Effluents on Planktonic	Streamflow Characteristics of the Yellowstone
Mixing,	Primary Production and Decomposition in a Coastal Brackish Water Environment. I. Interre-	River Basin, Montana, Through September 1982.
W85-01837 5B	lations Between Abiotic and Biotic Components of the Planktonic Ecosystem,	W85-01781 2E
Fate of epsilon-Caprolactam in the Aquatic En- vironment,	W85-01840 5C	Improvement of Flood-Frequency Estimates for
W85-01956 5B	World's Longest Tunnel,	Selected Small Watersheds in Eastern Kansa using a Rainfall-Runoff Model,
Aquatic Leeches (Hirudinea) as Bioindicators of	W85-02003 8A	W85-01786 2A
Organic Chemical Contaminants in Freshwater Ecosystems,	Zinc in Water and Sediments of Two Finnish Lakes,	Flood Potential of Fortymile Wash and its Prin
W85-01958 5A	W85-02065 5B	cipal Southwestern Tributaries, Nevada Tes Site, Southern Nevada,
Prediction of Ecotoxicological Behaviour of	FISH	W85-02037 21
Chemicals: Relationship between n-Octanol/ Water Partition Coefficient and Bioaccumula-	Changes in the Fish Fauna of the Former Gre- velingen Estuary, before and after the Closure in	Magnitude and Frequency of Floods from
tion of Organic Chemicals by Alga Chlorella, W85-01959 5B	1971,	Urban Streams in Leon County, Florida,
	W85-01765 6G	W85-02047 4/

		and the second second
Two-Component Extreme Value Distribution for Flood Frequency Analysis, W85-02151 2E	Classification and Description of Dolomitic Fab- rics of Rocks from the Floridan Aquifer, U.S.A., W85-01733 2F	FLOW DURATION Streamflow Characteristics of the Yellowstone River Basin, Montana, Through September
Physically Based Flood Frequency Distribution,	Irrigation of Public Use Areas by Land Applica-	1982, W85-01781 2E
W85-02168 2E	tion of Combined Industrial and Domestic Waste Effluent,	FLOW FREQUENCY
FLOOD PEAK	W85-01740 5D	Effects of the Drought of 1980-81 on Stream-
Floods of August 7-8, 1979, in Chautauqua County, New York, with Hydraulic Analysis of		flow and on Ground-water Levels in Georgia,
Canadaway Creek in the Village of Fredonia,	Origins and Distribution of Saline Ground Waters in the Floridan Aquifer in Coastal South-	W85-01783 2E
W85-02051 2E	west Florida,	FLOW ROUTING
Additional Tests on the Effect of Rainfall Inten-	W85-01778 2K	Basic Concepts of Kinematic-Wave Models,
sity on Storm Flow and Peak Flow from Wild-	Municipal Solid-Waste Disposal and Ground-	W85-02035 2A
Land Basins, W85-02166 2E	Water Quality in a Coastal Environment, West-	FLUID DROPS
	Central Florida, W85-01789 5E	Rainfall Energy From Drop Size Data, W85-01696 2B
FLOOD PEAKS Flood Elevations for the Soleduck River at Sol		
Duc Hot Springs, Clallam County, Washington,	Hydrology of Lake Padgett, Saxon Lake, and	FLUID MECHANICS
W85-01773 4A	Adjacent Area, Pasco County, Florida, W85-01826 7C	Mechanics of Mudflows, W85-01816 8B
Prediction of Peak Flows for Culvert Design on		
Small Watersheds in Oregon,	Distribution of Selected Chemical Constituents in Water from the Floridan Aquifer, Southwest	FLUIDIZED BED PROCESS
W85-01820 4A	Florida Water Management District,	Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control,
FLOOD PLAIN MANAGEMENT	W85-01928 7C	W85-01655 5D
Flood-plain Management Program in Rapid	Trends and Fluctuations in the Potentiometric	FLUORIDE
City, South Dakota, W85-01643 2E	Surface of the Floridan Aquifer, West-Central	Fluoride, Nitrate, and Dissolved-Solids Concen-
	Florida, 1961-80, W85-01940 7C	trations in Ground Waters of Washington,
FLOOD PROFILES Floods of August 7-8, 1979, in Chautauqua	W 83-01940	W85-01828 2F
County, New York, with Hydraulic Analysis of	Hydrogeology and Water Quality of Six Landfill	FLUORIDES
Canadaway Creek in the Village of Fredonia, W85-02051 2E	Sites in Hillsborough County, Florida, W85-01946 5B	Material Balance Analysis for Fluoride Ions in Experimental Waste Disposal Plant,
		W85-01732 5D
FLOOD RECURRENCE INTERVAL	Projected Public Supply and Rural (Self-Supplied) Water Use in Florida Through Year 2020,	ELICHING
Flood-Frequency Estimates for Five Gaged Basins in Wichita, Kansas.	W85-02036 7C	FLUSHING One-Dimensional Mixing and Flushing Model of
W85-01949 2A	D D D D D	the Ems-Dollard Estuary: Calculation of Time
FLOOD WAVES	Drainage Basins in Duval County, Florida, W85-02046 7C	Scales at Different River Discharges,
Groundwater Response under an Electronuclear		W85-01838 2L
Plant to a River Flood Wave Analyzed by a	Magnitude and Frequency of Floods from Urban Streams in Leon County, Florida,	Use of a Model to Assess Factors Affecting the
Nonlinear Finite Element Model, W85-02157 2F	W85-02047 4A	Oxygen Balance in the Water of the Dollard, W85-01839 2L
FLOODING	Pachagos and Discharge Areas of the Floridan	
Forests, Floods, and Erosion: A Watershed Ex-	Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Manage-	FLUVIAL SEDIMENT Sediment Transport in the Tanana River near
periment in the Southeastern Piedmont,	ment District and Vicinity, Florida,	Fairbanks, Alaska, 1982,
W85-01705 2J	W85-02049 7C	W85-01769 2J
Waterlogging Tolerance of Lowland Tree Spe-	Altitude and Generalized Configuration of the	FLUVIAL SEDIMENTS
cies of the South, W85-02111 2I	Top of the Floridan Aquifer, St. Johns County, Florida,	Diurnal Variation in the Oxygen Uptake of
	W85-02050 7C	River Sediments in Vitro by Use of Continuous Flow-Through Systems,
FLOODPLAINS Santa Ana River: An Example of a Sandy Braid-		W85-02069 2E
ed Floodplain System Showing Sediment Source	Hydrogeology of Well-Field Areas near Tampa, Florida, Phase 2Development and Documenta-	FLUX-AVERAGED CONCENTRATIONS
Area Imprintation and Selective Sediment Modi-	tion of a Quasi-Three-Dimensional Finite-Differ-	Flux-Averaged and Volume-Averaged Concen-
fication, W85-01735 2J	ence Model for Simulation of Steady-State	trations in Continuum Approaches to Solute
	Ground-Water Flow, W85-02052 2F	Transport, W85-02153 2F
FLOODS Improvement of Flood-Frequency Estimates for		
Selected Small Watersheds in Eastern Kansas	Deepwater Sediments and Trophic Conditions in Florida Lakes,	FOOD PROCESSING WASTES Blue Crab Processing Plant Effluent Treatment,
using a Rainfall-Runoff Model,	W85-02099 2H	W85-01741 5D
W85-01786 2A	FLORIDAN AQUIFER	
Floods of August 7-8, 1979, in Chautauqua	Classification and Description of Dolomitic Fab-	FORAMINIFERA Pollution Effects Monitoring With Foraminifera
County, New York, with Hydraulic Analysis of Canadaway Creek in the Village of Fredonia,	rics of Rocks from the Floridan Aquifer, U.S.A.,	as Indices in the Thana Creek, Bombay Area,
W85-02051 2E	W85-01733 2F	W85-01671 5C
FLORIDA	Altitude and Generalized Configuration of the	FORECASTING
Soils of Swamps in the Apalachicola, Florida,	Top of the Floridan Aquifer, St. Johns County, Florida,	Real-Time Estimation and Forecasting of Spa-
Estuary,	W85-02050 7C	tially Distributed Areal Rainfall, W85-01700 2E
W85-01641 2L		
Drought in Southeastern United States,	FLOW DISCHARGE Forecasting of Water Level and Discharge of	MINES: A Model to Forecast Mine Wastewater Ouality,
W85-01642 2B	the Elbe with the Aid of Fuzzy Modelling (Vor-	W85-01750 5E
Modeling Estuarine Nutrient Geochemistry in a	hersage von Wasserstand und Durchfluss für die Elbe mit Hilfe einer unscharfen Modellierung),	Forecasting of Water Level and Discharge of
Simple System, W85-01702 2L	W85-01973 2E	the Elbe with the Aid of Fuzzy Modelling (Vor

FORECASTING

hersage von Wasserstand und Durchfluss fur die Elbe mit Hilfe einer unscharfen Modellierung), W85-01973 2E	FREQUENCY ANALYSIS Improvement of Flood-Frequency Estimates for Selected Small Watersheds in Eastern Kansas	Origins and Distribution of Saline Ground Waters in the Floridan Aquifer in Coastal South- west Florida,
PORPOT MANAGEMENT	using a Rainfall-Runoff Model,	W85-01778 2K
FOREST MANAGEMENT Forests, Floods, and Erosion: A Watershed Ex-	W85-01786 2A	Physical and Geochemical Characteristics of
periment in the Southeastern Piedmont,	Flood-Frequency Estimates for Five Gaged	Suspended Solids, Wilton Creek, Ontario,
W85-01705 2J	Basins in Wichita, Kansas,	W85-02056 2H
	W85-01949 2A	
FOREST WATERSHEDS	FREQUENCY DISTRIBUTION	Geochemistry of the Rhine and the Rhone and
Forests, Floods, and Erosion: A Watershed Ex-	Physically Based Flood Frequency Distribution,	Human Impact (La Geochimie du Rhin et du
periment in the Southeastern Piedmont, W85-01705 2J	W85-02168 2E	Rhone et L'impact Humain),
48501765	PROPERTY.	W85-02059 2H
FORESTRY	FRESHETS Influence of Within-Stream Disturbance on Dis-	Climatic and Anthropogenic Effects on the Sedi-
Suggestion for Year-Round Wastewater Utiliza-	solved Nutrient Levels During Spates,	mentation and Geochemistry of Lakes Bourget,
tion in the Forestry Industry (Vorschlag zur ganzjahrigen Abwasserverwertung in der	W85-02089 2E	Annecy and Leman,
Forstwirtschaft),	FREUNDLICH ISOTHERMS	W85-02102 2H
W85-01971 5D	Use of Fixed-Bed Adsorber Models to Predict	GEOHYDROLOGY
	the Fluxes of Toxic Substances in Groundwaters	Ground Water in the Redding Basin, Shasta and
FORESTS	and Soil Environments,	Tehama Counties, California,
Drought Effect on High-Altitude Forests, Rua- hine Range, North Island, New Zealand,	W85-01793 5B	W85-01945 4B
W85-01886 2A	FRIEDRICHRODA	Halanda Indiana and America
7703-01000	Friedrichroda Wastewater Treatment Facility -	Hydrogeologic Investigation of Agana Swamp Northern Guam,
FORT DEVENS	Results of an Experiment (Klaranlage Friedrich-	W85-02029 2F
Fate of Trace Organics During Rapid Infiltra-	roda - Ergebnisse eines Experiments),	W 05-02025
tion of Primary Wastewater at Fort Devens,	W85-01884 5D	GEOLOGIC FRACTURES
Massachusetts, W85-01730 5D	FRY	Double-Porosity Models for a Fissured Ground-
W65-01730	Logging Impacts and Some Mechanisms that	water Reservoir with Fracture Skin,
FOUND LAKE	Determine the Size of Spring and Summer Pop-	W85-02150 2F
Historical Changes in Anthropogenic Lead Fall-	ulations of Coho Salmon Fry (Oncorhynchus	Contaminant Transport in Fractured Porous
out in Southern Ontario, Canada,	kisutch) in Carnation Creek, British Columbia,	Media: Analytical Solution for a Two-Member
W85-02063 5B	W85-01919 5C	Decay Chain in a Single Fracture,
POUNDATION ROCKS	FUNGI	W85-02170 5B
Earth Foundation Treatment at Jebba Dam Site,	Relative Contributions of Bacteria and Fungi to	GEOPHYSICAL LOGGING
W85-01871 8D	Rates of Degradation of Lignocellulosic Detri-	Geohydrologic Data for Test Well USW G-4,
PRACTURE ATTITUDE	tus in Salt-Marsh Sediments, W85-02138 2L	Yucca Mountain Area, Nye County, Nevada,
True Location and Orientation of Fractures	W 05-02130	W85-02031 7C
Logged with the Acoustic Televiewer (Includ-	FURFURYL ALCOHOL	
ing Programs to Correct Fracture Orientation),	Singlet Oxygen in Surface Waters - Part I: Fur-	GEORGIA
W85-01780 2F	furyl Alcohol as a Trapping Agent, W85-01964 2K	Drought in Southeastern United States, W85-01642 2B
FRANCE	W 63-01704	W83-01042 2B
Areal Reduction Factors on Short Time and	FUZZY MODELING	Forests, Floods, and Erosion: A Watershed Ex-
Space Intervals,	Forecasting of Water Level and Discharge of	periment in the Southeastern Piedmont,
W85-01690 2B	the Elbe with the Aid of Fuzzy Modelling (Vor- hersage von Wasserstand und Durchfluss fur die	W85-01705 2J
Nice on the French Riviera - the Birthplace of	Elbe mit Hilfe einer unscharfen Modellierung),	Effects of the Drought of 1980-81 on Stream-
Drinking Water Treatment with Ozone (Nice,	W85-01973 2E	flow and on Ground-water Levels in Georgia,
sur la Riviera Française - Berceau du Traitement	GANAGAGIGUE CREEK	W85-01783 2E
de l'Eau par l'Ozone),	Aquatic Leeches (Hirudinea) as Bioindicators of	
W85-01988 5F	Organic Chemical Contaminants in Freshwater	Water Resources Data, Georgia, Water Year
General Strategy for Security in Water Supply,	Ecosystems,	1982, W85-01938 2E
W85-01990 5G	W85-01958 5A	W 63-01936 2E
Township Translations of the Company	GAS CHROMATOGRAPHY	Effect of Clear-Cut Silviculture on Dissolved
Towards Total Automation of Water Distribu- tion (Vers l'Automatisation Integrale dans la	Chemical Derivatization Analysis of Pesticide	Ion Export and Water Yield in the Piedmont,
Distribution d'Eau),	Residues. VIII. Analysis of 15 Chlorophenols in	W85-02171 5B
W85-02009 6A	Natural Water by In Situ Acetylation,	GEOSTATISTICAL APPROACH
	W85-02113 5A	Application of the Geostatistical Approach to
Climatic and Anthropogenic Effects on the Sedi-	Simultaneous Determination of Partition Coeffi-	the Inverse Problem in Two-Dimensional
mentation and Geochemistry of Lakes Bourget, Annecy and Leman,	cients and Acidity Constants of Chlorinated	Groundwater Modeling,
W85-02102 2H	Phenols and Guaiacols by Gas Chromatography,	W85-02169 2F
	W85-02115 5A	GEOTHERMAL WELLS
FRANKFURT (ODER)	GENEVA	Pressure Transient Analysis for Two-Phase
Suggestion for Year-Round Wastewater Utiliza- tion in the Forestry Industry (Vorschlag zur	Planning, Implementation of Directives and	Geothermal Wells: Some Numerical Results,
ganzjahrigen Abwasserverwertung in der	Pipelaying Standards,	W85-02163 2F
Forstwirtschaft),	W85-01998 6B	CERA
W85-01971 5D	GEOCHEMISTRY	GERA Observations from the Test Operation of an Ion-
FRENCH RIVIERA	Geochemistry of Well Water and Cardiovascu-	exchange Facility for Nitrate Removal in Drink-
Nice on the French Riviera - the Birthplace of	lar Diseases in Sri Lanka,	ing-water Treatment (Erfahrungen aus dem Er-
Drinking Water Treatment with Ozone (Nice,	W85-01674 5C	probengsbetrieb einer Ionenaustauscheranlage
sur la Riviera Française - Berceau du Traitement	Modeling Estuarine Nutrient Geochemistry in a	zur Nitratelimination in der Trinkwasseraufber-
de l'Eau par l'Ozone), W85-01988 SF	Simple System,	citung),
W85-01988 5F	W85-01702 2L	W85-01974 5F

GERMANY (FEDERAL REPUBLIC) Concrete in Hydraulic Engineering for a Better Environment (Beton im Wasserbau fur bessere Umwelt),	Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg- wick, and Weld Counties, Colorado, W85-01775 2F	Ground-Water Hydrology and Quality before and after Strip Mining of a Small Watershed in Jefferson County, Ohio, W85-01943
W85-01861 8F		
CT LOTAL TAPPO	Origins and Distribution of Saline Ground Waters in the Floridan Aquifer in Coastal South-	Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near
GLACIAL LAKES Water Temperature and Turbidity in Glacially	west Florida,	the East Unit, Indiana Dunes National Lake-
Fed Lake Tekapo,	W85-01778 2K	shore, Indiana, 1982,
W85-01637 2H	Ground Water in the Twenty-Nine Palms Indian	W85-01948 4A
GOVERNMENT POLICY	Reservation and Vicinity, San Bernardino	Major Aquifers in Miner County, South Dakota,
Major Institutional Arrangements Affecting Ground Water in New York State,	County, California, W85-01779 2F	W85-01950 2F
W85-01802 6E	Effects of the Drought of 1980-81 on Stream-	Bacteria in Works and Mains from Ground
	flow and on Ground-water Levels in Georgia,	Water Supplies, W85-02001 5F
GOVERNMENT SUPPORTS Training Programmes in Federal Systems of	W85-01783 2E	
Government.	Ground-water Quality in the Western Snake	Data for Ground-Water Studies of the San Juan Basin, New Mexico (1982-83),
W85-01989 6F	River Basin, Swan Falls to Glenns Ferry, Idaho,	W85-02034 7C
GRAND RIVER BASIN	W85-01784 2F	Occurrence, Quality, and Use of Ground Water
Mixing Zone Studies in the Grand River Basin,	Use of Fixed-Bed Adsorber Models to Predict	in Orcas, San Juan, Lopez, and Shaw Islands,
W85-01710 5B	the Fluxes of Toxic Substances in Groundwaters and Soil Environments,	San Juan County, Washington,
GREAT LAKES	W85-01793 5B	W85-02043 7C
Association between Net Basin Supplies to Lake		Effect of Noncoliforms on Coliform Detection
Superior and Supplies to the Lower Great	Major Institutional Arrangements Affecting Ground Water in New York State,	in Potable Groundwater: Improved Recovery
Lakes, W85-01755 2H	W85-01802 6E	with an Anaerobic Membrane Filter Technique,
W85-01755 2H	Description of Wells Deliver Land	W85-02140 5F
Spectral Attenuation and Irradiance in the Lau-	Records of Wells, Drillers' Logs, Water-Level Measurements, and Chemical Analyses of	Application of the Geostatistical Approach to
rentian Great Lakes, W85-01757 2H	Ground Water in Chambers, Liberty, and Mont-	the Inverse Problem in Two-Dimensional
W85-01757 2H	gomery Counties, Texas, 1975-79,	Groundwater Modeling, W85-02169 2F
Estimates of Dissolved and Suspended Sub-	W85-01818 2F	
stance Yield of Stream Basins in Michigan,	Fluoride, Nitrate, and Dissolved-Solids Concen-	Water Resources of the Fort Union Coal
W85-01942 5A	trations in Ground Waters of Washington,	Region, East-Central Montana.
Algal-Availability of Particulate Phosphorus	W85-01828 2F	W85-01772 2F
from Diffuse and Point Sources in the Lower Great Lakes Basin.	Water Resources Data, Kentucky, Water Year	Guide to North Dakota's Ground-Water Re-
W85-02061 2K	1982, W85-01923 2E	sources,
		W85-01824 2F
GREECE Mytilus galloprovincialis and Parapenaeus lon-	Three-Dimensional Digital-Computer Model of	GROUNDWATER BASINS
girostris as Bioindicators of Heavy Metal and	the Principal Ground-Water Reservoir of the Sevier Desert, Utah,	Ground Water in the Redding Basin, Shasta and
Organochlorine Pollution,	W85-01925 7C	Tehama Counties, California,
W85-01899 5A	Water-Level Maps of the Alluvial Aquifer,	W85-01945 4B
GREEN BAY	Northwestern Mississippi, April, 1982,	GROUNDWATER BUDGET
Role of Sediments in the Nitrogen Budget of	W85-01926 7C	Three-Dimensional Digital-Computer Model of
Lower Green Bay, Lake Michigan,	Annual Water-Resources Review, White Sands	the Principal Ground-Water Reservoir of the Sevier Desert, Utah,
W85-01754 5B	Missile Range, New Mexico, 1982,	W85-01925 7C
GREIZ	W85-01927 2E	GROUNDWATER CONTAMINATION
Results and Experience of the Greiz Water-	Water Resources Data, Iowa, Water Year 1982,	Guide to North Dakota's Ground-Water Re-
Supply District in the Field of Rational Water Use (Ergebnisse und Erfahrungen des Versor-	W85-01931 2E	sources,
gungsbereichs Greiz bei der rationellen Wasser-	Water Resources Data, New Hampshire and	W85-01824 2F
verwendung),	Vermont, Water Year 1982,	GROUNDWATER DISCHARGE
W85-01880 3D	W85-01933 2E	Recharge and Discharge Areas of the Floridan
GREVELINGEN ESTUARY	Water Resources Data, Arkansas, Water Year	Aquifer in the St. Johns River Water Manage- ment District and Vicinity, Florida,
Changes in the Fish Fauna of the Former Gre-	1982,	W85-02049 7C
velingen Estuary, before and after the Closure in 1971,	W85-01934 2E	CROUNDINATED ELOW
W85-01765 6G	Water Resources Data, Massachusetts and	GROUNDWATER FLOW Computer Program and Data Listing for Two-
GROUND WATER	Rhode Island, Water Year 1982, W85-01935 2E	Dimensional Ground-Water Model for Laramie
Records of Wells, Drillers' Logs, Water-Level		County, Wyoming, W85-01787 7C
Measurements, and Chemical Analyses of	Water Resources Data, North Dakota, Water	W85-01787 7C
Ground Water in Brazoria, Fort Bend, and	Year 1982, W85-01936 2E	GROUNDWATER LEVEL
Waller Counties, Texas, 1975-79, W85-01819 2F		Ground Water in the Redding Basin, Shasta and Tehama Counties, California,
	Water Resources Data, South Carolina, Water Year 1982,	W85-01945 4B
GROUND-WATER LEVELS	W85-01937 2E	
Effects of the Drought of 1980-81 on Stream- flow and on Ground-water Levels in Georgia,	Water Percurses Date Georgie Water Voca	Groundwater Response under an Electronuclear Plant to a River Flood Wave Analyzed by a
W85-01783 2E	Water Resources Data, Georgia, Water Year 1982,	Nonlinear Finite Element Model,
	W85-01938 2E	W85-02157 2F
GROUNDWATER Change in Quality of Thermal Groundwater	Water Resources Data, Alabama, Water Year	GROUNDWATER LEVELS
From a Unique Resource in Lebanon,	1982,	Effects of Channel Excavation on Water-Quality
W85-01673 2F	W85-01939 2E	Characteristics of the Black River and on

GROUNDWATER LEVELS

Ground-Water Levels near Dunn, North Caroli-	GROUNDWATER RECHARGE	HAMILTON HARBOUR Experimental Measurement of Sediment Nitrifi-
ma, W85-01924 2A	Geohydrology of the Meadowbrook Artificial- Recharge Project Site in East Meadow, Nassau	cation and Denitrification in Hamilton Harbour,
GROUNDWATER MANAGEMENT Guide to North Dakota's Ground-Water Re-	County, New York, W85-01774 2F	Canada, W85-02070 2H
sources, W85-01824 2F	Three-Dimensional Digital-Computer Model of the Principal Ground-Water Reservoir of the	HARBORS Heavy Metals in Ulva lactuca Collected within
Competition Versus Optimal Control in Ground- water Pumping when Demand is Nonlinear,	Sevier Desert, Utah, W85-01925 7C	Tolo Harbour, An Almost Landlocked Sea, W85-01762 5B
W85-02141 4B	Recharge and Discharge Areas of the Floridan	HAWII
GROUNDWATER MOVEMENT Geohydrology of the Meadowbrook Artificial- Recharge Project Site in East Meadow, Nassau	Aquifer in the St. Johns River Water Manage- ment District and Vicinity, Florida, W85-02049 7C	Exploratory Drilling and Aquifer Testing at the Kipahulu District Haleakala National Park, Maui, Hawaii, W85-01776 2F
County, New York, W85-01774 2F	GROUNDWATER RESOURCES Appraisal of Water from Surficial-Outwash	HAZARD ASSESSMENT
Hydrogeology and Water Quality of Six Landfill Sites in Hillsborough County, Florida,	Aquifers in Todd County and Parts of Cass and Morrison Counties, Central Minnesota,	Mechanics of Mudflows, W85-01816 8B
W85-01946 5B	W85-02038 4B	HAZARDOUS MATERIALS Characteristics of Leachates from Hazardous
Hydrogeologic Investigation of Agana Swamp Northern Guam, W85-02029 2F	GROWTH RATES Effects of the Herbicide Atrazine on an Oyster- Food Organism,	Waste Landfills, W85-02118 5B
Hydrogeology of Well-Field Areas near Tampa,	W85-01808 5C	HEAT TRANSFER
Florida, Phase 2-Development and Documenta-	GUAIACOLS	Ice Cover Melting in a Shallow River,
tion of a Quasi-Three-Dimensional Finite-Differ- ence Model for Simulation of Steady-State Ground-Water Flow.	Simultaneous Determination of Partition Coeffi- cients and Acidity Constants of Chlorinated	W85-01713 2C Transport Phenomena New Experimental Re-
W85-02052 2F	Phenols and Guaiacols by Gas Chromatography, W85-02115 5A	sults in Hydrodynamical 'Forced Rayleigh Scat- tering' (Phenomenes de Transport Nouveaux
Influence of Simulated Groundwater-Movement on the Phosphorus Release from Sediments, as Measured in a Continuous Flow System,	GUAM Feasibility Study of Developing Valley-Fill	resultats experimentaux en diffusion 'Rayleigh forcee' hydrodynamic), W85-01745
W85-02094 2F	Aquifers for Village Water Supplies in Southern Guam,	HEAVY METALS
Three-Dimensional Streamlines in Dupuit-	W85-02026 2F	Analysis of Aqueous Sediments for Heavy
Forchheimer Models, W85-02148 2F	Diagenesis and Pore-Space Evolution within Recent and Pleistocene Carbonate Units of	Metals, W85-01742 5B
Double-Porosity Models for a Fissured Ground- water Reservoir with Fracture Skin,	Orote Peninsula, Guam, W85-02027 2F	Heavy Metals in the Lower Mississippi River, W85-01744 5B
W85-02150 2F	Hydrogeologic Investigation of Agana Swamp	Trace Metal Concentrations of the Waters of a
Motion of Two Compressible Fluids with Inter- face in a Porous Reservoir,	Northern Guam, W85-02029 2F	South Indian River, W85-01751 5B
W85-02154 2F	GUELPH LAKE	Heavy Metals in Ulva lactuca Collected within
Darcy's Flow with Variable Permeability: A Boundary Integral Solution,	Phytoplankton Population Dynamics of a Small Reservoir: Effect of Intermittent Mixing on Phy- toplankton Succession and the Growth of Blue-	Tolo Harbour, An Almost Landlocked Sea, W85-01762 5B
W85-02165 2F	green Algae,	Accumulation of the Trace Elements Lead and
GROUNDWATER POLLUTION Groundwater Quality Survey of an Unsewered,	W85-01916 2H	Zinc by Asellus communis at Three Different pH Levels,
Semi-Rural Area, W85-01633 5B	GUTERSTEIN Kinetic Factors of CaCO3-Precipitation and the	W85-01795 5B
Origin of Nitrates in Groundwater of the Bunz Valley (Woher stammen die Nitrate im Grun-	Partitioning of 12C and 13C. Studies at the Wa- terfalls of Guterstein and Urach (Schwabische	Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands, W85-01805 5B
wasser des Bunztales),	Alb) (Kinetische Faktoren der CaCO3-Abschei- dung und der Fraktionierung von 12C und 13C.	
W85-01856 5B	Untersuchungen an den Wasserfallen von Guter- stein und Urach (Schwabische Alb)),	Heavy Metal Migration in Soil-Leachate Sys- tems,
Hydrogeology and Water Quality of Six Landfill Sites in Hillsborough County, Florida,	W85-01662 1B	W85-01868 5E
W85-01946 5B Pesticides in Groundwater Beneath the Central	HABITAT SUITABILITY INDEX Breeding Mallard (Anas platyrhynchos) Habitat	Mytilus galloprovincialis and Parapenaeus lon- girostris as Bioindicators of Heavy Metal and Organochlorine Pollution,
Sand Plain of Wisconsin, W85-02025 5B	Suitability Model, W85-01792 6G	W85-01899 5A
Comparison of the Carcinogenic Risks from Fish	HABITATS	Spatial and Temporal Trends in Heavy Meta
vs. Groundwater Contamination by Organic Compounds,	Trophic Response of Fishes to Habitat Variabili- ty in Coastal Seagrass Systems,	Concentrations in Mussels from Northern Ire land Coastal Water, W85-01901 5A
W85-02110 5C	W85-01890 2L	
GROUNDWATER POTENTIAL Feasibility Study of Developing Valley-Fill	HAKODATE BAY Behavior of Organically-Bound Iron in Seawater	Control of Metal Contaminants in Drinking Water in Denmark, W85-01993
Aquifers for Village Water Supplies in Southern Guam,	of Estuaries, W85-01913 2L	Accumulative Phases for Heavy Metals in
W85-02026 2F	HALOGENATED HYDROCARBONS	Limnic Sediments,
GROUNDWATER QUALITY	Determination of Organohalogenic Acids in	
Guide to North Dakota's Ground-Water Re- sources,	Water Samples (Bestimmung Halogenorgan- ischer Sauren in Wasserproben),	Standardization of Methods of Analysis fo Heavy Metals in Sediments,
W85-01824 2F	W85-01663 5A	

HELSINKI	HUMIC SUBSTANCES	HYDROELECTRIC POWER
World's Longest Tunnel,	Contact Flocculation-Filtration of Humic Sub-	Report on Hydroelectric Power Utilization and
W85-02003 8A	stances,	Reserved-Water Problems (Bericht uber Was- serkraftuntzung und Restwasserprobleme).
HERBICIDES	W85-01722 5D	W85-01855 4A
Effects of the Herbicide Atrazine on an Oyster-	HURUNUI RIVER	W 05-01055
Food Organism,	Critical Depths for Passage in Braided Rivers,	HYDROELECTRIC POWERPLANTS
W85-01808 5C	Canterbury, New Zealand,	Asynchronous Generator; An Alternative to the
Development of the Schwarzheide Chemical	W85-01636 2E	Synchronous Generator for Small Hydroelectric Power Stations with Output up to 20,000 kW
Synthesis Works in the Field of Wastewater and	HYDRAULIC CONDUCTINITY	(Der Asynchrongenerator; Eine Alternative zum
By-product Treatment (Entwickling des VEB	Aquifer Tests in the Stratified Drift, Chipuxet	Synchrongenerator fur kleine Wasserkraftanla-
Synthesewerk Schwarzheide auf dem Gebiet der	River Basin, Rhode Island,	gen mit einer Leistung bis 20000 kW),
Abwasser- und Abproduktbehandlung),	W85-02039 2F	W85-01858 8C
W85-01881 5D	The state of the s	HYDROGEN ION CONCENTRATION
Longterm Effects of the Herbicides Atrazine	HYDRAULIC CONDUCTIVITY	Aerobic Sludge Digestion with pH Control -
and Dichlobenil upon the Phytoplankton Densi-	Geohydrologic Data for Test Well USW G-4, Yucca Mountain Area, Nye County, Nevada,	Preliminary Investigation,
ty and Physico-chemical Conditions in Compart-	W85-02031 7C	W85-01660 5D
ments of a Freshwater Pond,	W 05-02051	Accumulation of the Trace Elements Lead and
W85-01967 5C	HYDRAULIC DESIGN	Zinc by Asellus communis at Three Different
HIGH ALTITUDE	Rainfall Data For the Design of Detention	pH Levels,
Erosion Control at High Altitudes (Erosionsbe-	Basins,	W85-01795 5B
kampfung im Hochgebirge),	W85-01695 2E	Influence of Acid Precipitation on Stream Inver-
W85-01863 4D	HYDRAULIC ENGINEERING	tebrates,
HIGH ASWAN DAM	Concrete in Hydraulic Engineering for a Better	W85-01807 5C
Effects of Sedimentation on the Storage Capac-	Environment (Beton im Wasserbau fur bessere	www.comou.com
ity of the High Aswan Dam Reservoir,	Umwelt),	HYDROGEOLOGY
W85-02101 4A	W85-01861 8F	Ground-water Quality in the Western Snake River Basin, Swan Falls to Glenns Ferry, Idaho,
THE PERSON AND TRAINS	HYDRAULICS	W85-01784 2F
HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY	Evolving Data Processing Environment For	
Initial Studies on the Use of High-Performance	Computational Hydraulics Systems,	Hydrogeology of Well-Field Areas near Tampa,
Liquid Chromatography for the Rapid Assess-	W85-01709 7C	Florida, Phase 2-Development and Documenta- tion of a Quasi-Three-Dimensional Finite-Differ-
ment of Sewage Treatment Efficiency,	HYDRILLA	ence Model for Simulation of Steady-State
W85-01721 5D	Investigation of Two Possible Modes of Action	Ground-Water Flow,
HIGH PLAINS AQUIFER	of the Inert Dye Aquashade on Hydrilla,	W85-02052 2F
Hydrologic Maps of the High Plains Aquifer,	W85-02122 4A	HYDROLOGIC BUDGET
January 1981, Southwestern Kansas,	and the state of t	Association between Net Basin Supplies to Lake
W85-01930 7C	HYDROCARBONS	Superior and Supplies to the Lower Great
	Aromatic Hydrocarbons in Waters of Port Phil- lip Bay and the Yarra River Estuary,	Lakes,
HIGH PLAINS REGIONAL AQUIFER SYSTEM Water-Level Changes in the High Plains Re-	W85-01644 5B	W85-01755 2H
gional Aquifer, Northwestern Oklahoma, Prede-		Water Balance and Crops in Karnataka,
velopment to 1980,	Hydrocarbons in Washington Coastal Sedi-	W85-02127 2I
W85-01771 2F	ments,	The state of the s
HORONG BAY	W85-01915 5B	HYDROLOGIC CYCLE
HOBSONS BAY Aromatic Hydrocarbons in Waters of Port Phil-	Hydrocarbon Accumulation in Freshwater Sedi-	New Ecological Approach to the Water Cycle: Ticket to the Future,
lip Bay and the Yarra River Estuary,	ments of an Urban Catchment,	W85-01704 6A
W85-01644 5B	W85-02078 5B	
	HYDRODYNAMICS	HYDROLOGIC DATA
HOLIDAY LAKE		Evolving Data Processing Environment For Computational Hydraulics Systems,
Oil Spill Focuses Attention on the Problems of a Man-Made Recreational Lake,	W85-01716 5D	W85-01709 7C
W85-01650 5B		
	Transport Phenomena New Experimental Re-	Machine-Readable Data Files from the Madison
HONG KONG	sults in Hydrodynamical 'Forced Rayleigh Scat- tering' (Phenomenes de Transport Nouveaux	Limestone and Northern Great Plains Regional Aquifer System Analysis Projects, Montana, Ne-
Heavy Metals in Ulva lactuca Collected within Tolo Harbour, An Almost Landlocked Sea,	resultats experimentaux en diffusion 'Rayleigh	braska, North Dakota, South Dakota, and Wyo-
W85-01762 5B		ming,
W 05-01702	W85-01745 1A	W85-01790 7C
HOTELS		Daily Water and Sediment Discharges from Se-
Analysis of Quantitative Wastewater Measure		lected Rivers of the Eastern United States: A
ments of a Country Restaurant Situated at Ap- proximately 1080 m Altitude and of a Mountain		Time-Series Modeling Approach,
Inn Situated at Approximately 1410 m Altitude		W85-01823 2J
(Auswertung von Schmutzwasser-Mengenmes-		Highlights of the 1983 Federal-State Coopera-
sungen bei einem Ausflugsrestaurant, rund 1080		tive Water Resources Program,
m u. M. und bei einem Berggasthof, rund 1410 m	Weinzodl Power Station on the Mur (Das Kraftwerk Weizodl an der Mur),	W85-01829 9D
u. M.), W85-01854 5D		Water Davis Date Ventucky Water Vent
W85-01854 5D		Water Resources Data, Kentucky, Water Year 1982.
HOUSTON	Construction of the Alicura Hydroelectric Facil-	W85-01923 2E
Analysis of Aqueous Sediments for Heavy		
Metals,	Alicura in Argentinien), W85-01862 8A	Annual Water-Resources Review, White Sands
W85-01742	W 83-01002 8A	Missile Range, New Mexico, 1982, W85-01927 2E
HUMAN POPULATION	Hydroelectric Power Station at the Netstal Lime	
New Ecological Approach to the Water Cycle		Hydrologic Maps of the High Plains Aquifer
Ticket to the Future,	Netstal AG),	January 1981, Southwestern Kansas, W85-01930 70
W85-01704 6A	W85-01866 8A	W85-01930 7C

HYDROLOGIC DATA

Water Resources Data, Iowa, Water Year 1982, W85-01931 2E	ILLINOIS Potential Urban Rainfall Prediction Measure-	INDUSTRIAL DISCHARGE Fishable Waters Everywhere: An Appropriate
Water Resources Data, New Hampshire and Vermont, Water Year 1982,	ment System, W85-01701 2B	Goal, W85-01850 6B
W85-01933 2E	IMPINGMENT	INDUSTRIAL WASTES
Water Resources Data, Arkansas, Water Year 1982, W85-01934 2E	Traveling Screens as Sampling Gear for Vertical Distribution Studies, W85-01842 7B	Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control, W85-01655 5D
W85-01934 2E	INCINERATION	
Water Resources Data, Massachusetts and Rhode Island, Water Year 1982, W85-01935 2E	Waste Management Scenarios for Minnesota's Twin Cities, W85-01867 5E	Blue Crab Processing Plant Effluent Treatment, W85-01741 5D
		Analysis of Aqueous Sediments for Heavy
Water Resources Data, North Dakota, Water Year 1982, W85-01936 2E	INCOME REDISTRIBUTION Irrigated Agricultural Expansion Planning in Developing Countries: Income Redistribution	Metals, W85-01742 5B
Water Resources Data, South Carolina, Water	Objective, W85-02143	Reduction of Costs and Liability Risks in Electroplating Wastewater Treatment,
Year 1982, W85-01937 2E	INDIA	W85-01852 5D
Water Resources Data, Georgia, Water Year	Pollution Effects Monitoring With Foraminifera as Indices in the Thana Creek, Bombay Area,	Method for Total Organic Chlorine Determina-
1982, W85-01938 2E	W85-01671 5C	tion in Bleach Plant Recipient Waters, W85-01962 5A
	Influence of Physico-Chemical Factors on the	Enzymatic Hydrolysis Tests on an Industrial
Water Resources Data, Alabama, Water Year 1982, W85-01939 . 2E	Coliform Bacteria in a Closed-Lake Water System, W85-01672 2H	Effluent Prior to its Biological Purification (Essais d'Hydrolyse Enzymatique d'un Effluent Industriel avant son Epuration Biologique),
HYDROLOGIC DATA COLLECTIONS	Distribution and Periodicity of Total, Faecal	W85-01975 5D
Computation of Continuous Streamflow	Coliform Bacteria in an Aquatic Ecosystem,	
Records, W85-02053 2E	W85-01675 5B	INDUSTRIAL WASTEWATER Development of the Schwarzheide Chemical
HYDROLOGIC DATA NETWORKS	Trace Metal Concentrations of the Waters of a	Synthesis Works in the Field of Wastewater and
Estimates of Dissolved and Suspended Sub-	South Indian River, W85-01751 5B	By-product Treatment (Entwickling des VEB Synthesewerk Schwarzheide auf dem Gebiet der
stance Yield of Stream Basins in Michigan, W85-01942 5A	Status of Research and Development in Water	Abwasser- und Abproduktbehandlung), W85-01881 5D
HYDROLOGIC MODELS	Supply Systems in India, W85-01982 3D	
Nash Model Relation to Horton Order Ratios, W85-02158 2A	Current Water Treatment Practices in Western	Model for Instream Regulation of Radioisotopes and Heavy Metals in Riverine Waters Subjected
HYDROLOGY	India - Case Studies of Two Metropolitan Cities, Bombay and Ahmedabad,	to a Uranium Mill Discharge, W85-02068 5B
Evolving Data Processing Environment For	W85-02024 5F	Evaluation of Electrode Methods for Determin-
Computational Hydraulics Systems, W85-01709 7C	Agricultural Droughts at Peddapuram, East Go-	ing Total Residual Chlorine in Various Water Matrices,
Estimation of Skewness of Hydrologic Varia-	davari District, Andhra Pradesh, W85-02126 2I	W85-02123 7B
bles,		
W85-02161 2A	Water Balance and Crops in Karnataka, W85-02127 2I	INDUSTRIAL WATER Status of Reverse Osmosis vs. Ion Exchange for
HYDROLYSIS Enzymatic Hydrolysis Tests on an Industrial	Some Observations on the Chemical Composi-	Petroleum/Petrochemical Utilities, W85-01853 5F
Effluent Prior to its Biological Purification (Essais d'Hydrolyse Enzymatique d'un Effluent	tion of Precipitation in an Industrial Area and It's Use in Air Quality Assessment,	Case for Automated Water Management,
Industriel avant son Epuration Biologique),	W85-02129 5B	W85-02130 6A
W85-01975 5D	INDIAN LANDS	INFILTRATION
HYDROMETRY	Estimation of Natural Streamflow in the Jemez River at the Boundaries of Indian Lands, Central	Travel Times from Buried and Surface Infiltra-
Computation of Continuous Streamflow Records,	New Mexico,	tion Point Sources,
W85-02053 2E	W85-02048 2E	W85-02167 2G
HYPOLIMNION	INDIANA	INFLOW
Dependence of Hypolimnetic Oxygen Consump- tion on Ambient Oxygen Concentration: Fact or	Effect of Various Hydrologic Parameters on the Quality of Stormwater Runoff from a West La-	Predominant Headwater Inflow and its Control of Lake-River Interactions in Lake Wakatipu,
Artifact, W85-02149 2H	fayette, Indiana Urban Watershed, W85-01822 5B	W85-01638 2H
		INSECTICIDE
ICE COVER Microorganism Survival in an Ice-Covered River,	Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near the East Unit, Indiana Dunes National Lake-	Determination of 4-Aminophenol in Water by High-Performance Liquid Chromatography
W85-01708 5B	shore, Indiana, 1982, W85-01948 4A	with Fluorescence Detection, W85-01746 5A
Ice Cover Melting in a Shallow River, W85-01713 2C	INDICATORS	INSPECTION
	Microorganism Survival in an Ice-Covered	Results of Surface-water, Dyke, and Coastal In- spection Ways Toward More Effective In-
Net Atmospheric Inputs of PCBs to the Ice Cover on Lake Huron,	River, W85-01708 5B	spection for the Future,
W85-01759 5B	INDUCED INFILTRATION	W85-01874 4A
IDAHO Ground-water Quality in the Western Snake	Geohydrology of the Meadowbrook Artificial- Recharge Project Site in East Meadow, Nassau	INSTITUTIONAL ARRANGEMENTS Major Institutional Arrangements Affecting
River Basin, Swan Falls to Glenns Ferry, Idaho,	County, New York,	Ground Water in New York State,

INSTITUTIONAL CONSTRAINTS	zur Nitratelimination in der Trinkwasseraufber-	ISRAEL
Evaluation of the Visibility Criterion of the Mas- sachusetts Sanitary Code for Swimming in Natu-	eitung), W85-01974 5F	Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine
ral Waters,		Dioxide,
W85-01800 6E	IOWA	W85-01743 5A
Major Institutional Arrangements Affecting	Water Resources Data, Iowa, Water Year 1982, W85-01931 2E	Simultaneous Concentration of Four Enterovir-
Ground Water in New York State,		uses from Tap, Waste, and Natural Waters,
W85-01802 6E	Application of the Geostatistical Approach to	W85-02137 5A
INSTREAM FLOW	the Inverse Problem in Two-Dimensional	· Carlotte of the same of the
Integrated Methodology for Instream Flow	Groundwater Modeling, W85-02169 2F	ITALY
Strategies,	W 65-02109	Sedimentation Rates in a Swiss-Italian Lake
W85-01951 5B	IRON	Measured with Sediment Traps, W85-02100 23
INSTREAM USE	Behavior of Organically-Bound Iron in Seawater	W 03-02100
Quantifying the Relative Performance of Alter-	of Estuaries, W85-01913 2L	Two-Component Extreme Value Distribution
native Measures for Fulfilling Instream Uses in	W63-01913	for Flood Frequency Analysis,
the Plains Environment,	Interaction Between Interstitial Water and Sedi-	W85-02151 2E
W85-02107 6B	ment in Two Cores of Lac Leman, Switzerland,	ITALY NUCLEAR POWERPLANTS
INSTREAM USE PROBABILITIES	W85-02084 2H	Groundwater Response under an Electronuclear
Quantifying the Relative Performance of Alter-	Flux of Reduced Chemical Constituents	Plant to a River Flood Wave Analyzed by a
native Measures for Fulfilling Instream Uses in	(Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-	Nonlinear Finite Element Model,
the Plains Environment, W85-02107 6B	ment Oxygen Demand in Lake Erie,	W85-02157 2F
	W85-02087 2H	JAMES RIVER
INTENSITY-DURATION-FREQUENCY	Transport of Iron and Manganese in Relation to	Annual Cycle of Kepone Residue and Lipid
CURVES Synthetic Design Storm and its Relation to In-	the Shapes of Their Concentration-Depth Pro-	Content of the Estuarine Clam, Rangia cuneata,
tensity-Duration Frequency Curves,	files,	W85-01844 5C
W85-01679 2B	W85-02090 2K	Acute Toxicity of Kepone to Selected Freshwa-
	IRON OXIDES	ter Fishes,
Statistical Methods of Storm Analysis, W85-01680 2B	Effects of Phosphate Fertilizer Applications and	W85-01846 5C
W 83-01080 2B	Chemistry-Mineralogy of the Iron Oxide System	
INTERBASIN TRANSFERS	on Phosphate Adsorption-Desorption by Stream	Kepone Concentration in Juvenile Anadromous Fishes.
Managing Water Scarcity: An Evaluation of In-	Sediments, W85-01794 5B	W85-01847 5B
terregional Transfers, W85-02145 6F		
	IRRADIANCE	Uptake of Kepone from Sediment Suspensions
INTERNATIONAL COOPERATION	Spectral Attenuation and Irradiance in the Lau- rentian Great Lakes.	and Subsequent Loss by the Oyster Crassostrea virginia,
International Cooperation and Acid Rain Pollu- tion: Establishing the Framework for Control,	W85-01757 2H	W85-01897 5B
W85-01670 6E	11-2-	The state of the s
The last of the la	IRRIGATION	JAPAN
INTERSTITIAL GASES Chemical Study of the Interstitial Water Dis-	Irrigation of Public Use Areas by Land Applica- tion of Combined Industrial and Domestic	Behavior of Organically-Bound Iron in Seawater of Estuaries,
solved Organic Matter and Gases in Lake Erie,	Waste Effluent,	W85-01913 2L
Cleveland Harbor, and Hamilton Harbour	W85-01740 5D	
Bottom SedimentsComposition and Fluxes to	W. I. O. P	Summer Peak of Nutrient Concentrations in
Overlying Waters, W85-01814 5B	Yield and Quality of Cotton Grown with Wastewater,	Lake Water, W85-02098 5B
W63-01614	W85-01869 5D	W 83-02098
INTERSTITIAL WATER		JAR TESTS
Interaction Between Interstitial Water and Sedi- ment in Two Cores of Lac Leman, Switzerland,	Irrigated Agricultural Expansion Planning in	Sedimentation Success from Modified Jar Tests,
W85-02084 2H	Developing Countries: Investment Scheduling Incorporating Drainage Water Reuse,	W85-01910 5F
	W85-02142 3F	JERBA DAM
Availability of Dissolved Oxygen in Interstitial		Earth Foundation Treatment at Jebba Dam Site,
Waters of a Sandy Creek, W85-02103 2E	Irrigated Agricultural Expansion Planning in Developing Countries: Income Redistribution	W85-01871 8D
	Objective,	TORDAN AGUIFED
INVERTEBRATES	W85-02143 3F	JORDAN AQUIFER Application of the Geostatistical Approach to
Organic Wastewater Effects on Benthic Inverte- brates in the Manawatu River,		the Inverse Problem in Two-Dimensional
W85-01632 5C	Irrigated Agricultural Expansion Planning in Developing Countries: Resilient System Design,	Groundwater Modeling,
* * * * * * * * * * * * * * * * * * *	W85-02144 6A	W85-02169 2F
Influence of Acid Precipitation on Stream Inver-		JUDICIAL DECISIONS
tebrates, W85-01807 5C	IRRIGATION EFFICIENCY	Tort Recovery of Acid Rain Damages in the
	Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains,	United States - Observations on Plaintiff's Prima
INVESTMENT SCHEDULING	W85-01952 3F	Engin Casa
Irrigated Agricultural Expansion Planning in Developing Countries: Investment Scheduling		W85-01667 6E
Incorporating Drainage Water Reuse,	IRRIGATION SCHEDULING	Acid Rain and Federal Common Law,
W85-02142 3F	Developing the Resource Potential of a Shallow Water Table.	W85-01668 6E
ION EXCHANGE	W85-01832 3B	
Status of Reverse Osmosis vs. Ion Exchange for		Legal Aspects of Acidic Precipitation,
Petroleum/Petrochemical Utilities,	Real Time Irrigation Scheduling via 'Reaching'	W85-01669 6E
W85-01853 5F	Dynamic Programming, W85-02155 3F	KABALEBO RIVER
Observations from the Test Operation of an Ion-		Some Ecological Consequences of a Projected
exchange Facility for Nitrate Removal in Drink-	ISOTHERMS	Deep Reservoir in the Kabalebo River in Surin-
ing-water Treatment (Erfahrungen aus dem Er- probengsbetrieb einer Ionenaustauscheranlage	Adsorption of Surfactants on Sediments, W85-01960 5A	ame, W85-01764 6G
probengsbetrieb einer ionenaustauscheraniage	# 43-01700 JA	

ANSAS	LABORATORIES	Net Atmospheric Inputs of PCBs to the Ice
Hydrologic Responses of Stream's to Mining of	Automated Water Laboratory - What Benefit to	Cover on Lake Huron,
the Mulberry Coal Reserves in Eastern Kansas,	the Consumer, W85-02011 7B	W85-01759 5B
W85-01782 2E	W 63-02011 /B	LAKE KOYAMAIKE
Improvement of Flood-Frequency Estimates for	LABORATORY EQUIPMENT	Summer Peak of Nutrient Concentrations in
Selected Small Watersheds in Eastern Kansas	Automated Water Laboratory - What Benefit to the Consumer.	Lake Water,
using a Rainfall-Runoff Model, W85-01786 2A	W85-02011 7B	W85-02098 5B
W85-01786 2A		LAKE LEMAN
Hydrologic Maps of the High Plains Aquifer,	LAC LEMAN Basic Concepts and Associated Statistical Meth-	Climatic and Anthropogenic Effects on the Sedi-
January 1981, Southwestern Kansas,	odology in the Geochemical Study of Lake	mentation and Geochemistry of Lakes Bourget,
W85-01930 7C	Sediments,	Annecy and Leman, W85-02102 2H
Water Resources Data, Kansas Water Year	W85-02064 2J	W 05-02102
1982,	Manganese Cycle in Lac Leman, Switzerland:	LAKE LUGANO
W85-01932 2E	The Role of Metallogenium,	Sedimentation Rates in a Swiss-Italian Lake
Application of Remote-Sensing Techniques to	W85-02081 2H	Measured with Sediment Traps, W85-02100 2J
Hydrologic Studies in Selected Coal-Mined	Interaction Between Interstitial Water and Sedi-	W 63-02100
Areas of Southeastern Kansas,	ment in Two Cores of Lac Leman, Switzerland,	LAKE MALLASVESI
W85-01947 5B	W85-02084 2H	Zinc in Water and Sediments of Two Finnish
Flood-Frequency Estimates for Five Gaged		Lakes,
Basins in Wichita, Kansas,	LAGOONS Study Cases of Operative Conditions of Munici	W85-02065 5B
W85-01949 2A	Study Cases of Operative Conditions of Munici- pal Treatment by Lagooning (Etude des Condi-	LAKE MICHIGAN
On the last Palatin Profession of Alban	tions de Fonctionnement et d'Exploitation de	Role of Sediments in the Nitrogen Budget of
Quantifying the Relative Performance of Alter- native Measures for Fulfilling Instream Uses in	Quelques Cas Concrets de Traitement d'Eaux	Lower Green Bay, Lake Michigan,
the Plains Environment.	Residuaires Urbaines par Lagunage),	W85-01754 5B
W85-02107 6B	W85-01976 5D	Satellite-Tracked Current Drifters in Lake
	LAKE ANNECY	Michigan,
ANSU PROVINCE	Climatic and Anthropogenic Effects on the Sedi-	W85-01760 7B
Elemental Composition of Suspended Particles From the Yellow and Yangtze Rivers,	mentation and Geochemistry of Lakes Bourget,	LAKE ONALASKA
W85-01703 2J	Annecy and Leman,	Seasonal Study of a Freshwater Lake and Mi-
	W85-02102 2H	gratory Waterfowl for Campylobacter Jejuni,
APILA RIVER	LAKE BOURGET	W85-01639 5B
Trace Metal Concentrations of the Waters of a South Indian River.	Climatic and Anthropogenic Effects on the Sedi-	LIPEONEIRO
W85-01751 5B	mentation and Geochemistry of Lakes Bourget,	LAKE ONTARIO Predicting Variability in a Lake Ontario Phos-
	Annecy and Leman, W85-02102 2H	phorous Model,
CARST HYDROLOGY	W 03-02102 211	W85-01758 2H
Hydrogeology and Water Quality of Six Landfill	LAKE BRIELLE	T I THE RESIDENCE LINEARY
Sites in Hillsborough County, Florida, W85-01946 5B	Dynamic Phosphate Budget Model for a Eutro-	LAKE RESTORATION Acidified Lakes: Sediment Treatment with
W65-015-40	phic Lake, W85-02072 2H	Sodium Carbonate - A Remedy,
CENTUCKY		W85-02096 5G
Changes in the Naiad Fauna of the Cumberland	LAKE ERIE	
River below Lake Cumberland in Central Ken- tucky,	Oxygen Depletion in Central and Eastern Lake Erie: Relationship with Bacteria, Chlorophyll,	Lake Trehorningen Restoration Project.
W85-01921 6G	POC, and Morphometry,	Changes in Water Quality after Sediment Dredging,
	W85-01752 2H	W85-02097 5G
Water Resources Data, Kentucky, Water Year		
1982, W85-01923 2E	Occurrence of the Asiatic Clam Corbicula flu- minea in the Maumee River and Western Lake	LAKE SEDIMENTS
W 63-01923 ZE	Erie,	Analysis of Aqueous Sediments for Heavy Metals,
CEPONE	W85-01753 5C	W85-01742 5B
Annual Cycle of Kepone Residue and Lipid	T	
Content of the Estuarine Clam, Rangia cuneata,	Entrainment, Deposition, and Transport of Fine- Grained Sediments in Lakes,	Role of Sediments in the Nitrogen Budget of
W85-01844 5C	W85-02055 2J	Lower Green Bay, Lake Michigan, W85-01754 5B
Acute Toxicity of Kepone to Selected Freshwa-		W83-01754
ter Fishes,	Flux of Reduced Chemical Constituents	Bottom Dynamics in Lakes,
W85-01846 5C	(Fe(2+), Mn(2+), NH4(+) and CH4) and Sediment Oxygen Demand in Lake Erie,	W85-02054 2J
Kepone Concentration in Juvenile Anadromous	W85-02087 2H	Sedimentation in Fluvial and Lacustrine Envi-
Fishes,		ronments,
W85-01847 5B	LAKE ERIE BASINS	W85-02057 2J
Uptake of Kepone from Sediment Suspensions	Chemical Study of the Interstitial Water Dis-	Committee of Sediment France Testers Bell
and Subsequent Loss by the Oyster Crassostrea	solved Organic Matter and Gases in Lake Erie, Cleveland Harbor, and Hamilton Harbour	Comparison of Sediment Energy-Texture Rela- tionships in Marine and Lacustrine Environ-
virginia,	Bottom Sediments-Composition and Fluxes to	ments.
W85-01897 5B	Overlying Waters,	W85-02058 2J
CINEMATIC WAVE MODELS	W85-01814 5B	
Basic Concepts of Kinematic-Wave Models,	LAKE GEORGE	 Whole-Lake Lead Burdens in Sediments of Lakes in Southern Ontario, Canada,
W85-02035 2A	Microbial Metabolism in Surface Sediments and	W85-02062 5B
	its Role in the Immobilization of Phosphorus in	
RINETIC ENERGY	Oligotrophic Lake Sediments,	Basic Concepts and Associated Statistical Meth-
Rainfall Energy From Drop Size Data, W85-01696 2B	W85-02076 2J	odology in the Geochemical Study of Lake
	LAKE HURON	Sediments, W85-02064 2J
LA CROSSE	Influence of the St. Marys River Plume on	
Seasonal Study of a Freshwater Lake and Mi-	Northern Lake Huron Phytoplankton Assem-	Spatial Heterogeneity in Whole Lake Sediments
gratory Waterfowl for Campylobacter Jejuni, W85-01639 5B	blages,	- Towards a Loading Estimate,
	W85-01756 2H	W85-02073 2H

Microbial Metabolism in Surface Sediments and its Role in the Immobilization of Phosphorus in Oligotrophic Lake Sediments,	LAKES Vertical Temperature Distribution in Lakes, W85-01651 2H	Mechanisms of Metal Adsorption from Aqueous Solutions by Waste Tyre Rubber, W85-01724 5D
W85-02076 2J Accumulative Phases for Heavy Metals in	Distribution and Periodicity of Total, Faecal Coliform Bacteria in an Aquatic Ecosystem,	Accumulation of the Trace Elements Lead and Zinc by Asellus communis at Three Different
Limnic Sediments, W85-02077 5B	W85-01675 5B	pH Levels,
Dynamics and Mechanisms of Arsenite Oxida-	Release of Sediment-Phosphorus and the Influ-	
tion by Freshwater Lake Sediments,	ence of Algal Growth on This Process, W85-01761 2H	Bioavailability of Pb and Zn from Mine Tailings as Indicated by Erythrocyte delta-Aminolevu-
W85-02080 5B	Hydrology of Lake Padgett, Saxon Lake, and	linic Acid Dehydratase (ALA-D) Activity in Suckers (Pisces: Catostomidae),
Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh,	Adjacent Area, Pasco County, Florida, W85-01826 7C	W85-01918 5A
Northern Ireland, W85-02085 2H	Commentary on Environmental Impact Assess-	Whole-Lake Lead Burdens in Sediments of Lakes in Southern Ontario, Canada,
Available Phosphorus in Lake Sediments in the	ment for Large Projects Affecting Lakes and Streams.	W85-02062 5B
Netherlands, W85-02092 2H	W85-01920 6G	Historical Changes in Anthropogenic Lead Fall- out in Southern Ontario, Canada,
Mechanisms for Release of Sediment-Bound	Loading Concentration Models for Phosphate in	W85-02063 5B
Phosphate to Water and the Effects of Agricul- tural Land Management on Fluvial Transport of	Shallow Lakes, W85-02067 2H	LEAKAGE
Particulate and Dissolved Phosphate, W85-02095 5B	LAND APPLICATION	Computerized Distribution Records- CADD Paves the Way,
Summer Peak of Nutrient Concentrations in	Irrigation of Public Use Areas by Land Applica- tion of Combined Industrial and Domestic	W85-01902 5F
Lake Water, W85-02098 5B	Waste Effluent, W85-01740 5D	Leakage Control, W85-02016 3D
	LAND DISPOSAL	LEAST SQUARES METHOD
Deepwater Sediments and Trophic Conditions in Florida Lakes, W85-02099 2H	Fate of Trace Organics During Rapid Infiltra- tion of Primary Wastewater at Fort Devens, Massachusetts,	Parameter Identification of Groundwater Aqui- fer Models: A Generalized Least Squares Ap- proach,
LAKE SUPERIOR	W85-01730 5D	W85-02164 2F
Association between Net Basin Supplies to Lake Superior and Supplies to the Lower Great	Waste Management Scenarios for Minnesota's	LEBANON Change in Quality of Thermal Groundwater
Lakes, W85-01755 2H	Twin Cities, W85-01867 5E	From a Unique Resource in Lebanon, W85-01673 2F
LAKE SUWA	Suggestion for Year-Round Wastewater Utiliza-	Chlorine as an Algicide in a Conventional Water
Summer Peak of Nutrient Concentrations in Lake Water, W85-02098 5B	tion in the Forestry Industry (Vorschlag zur ganzjahrigen Abwasserverwertung in der Forstwirtschaft),	Treatment Plant, W85-01749 5F
LAKE TEKAPO	W85-01971 5D	LEECHES
Water Temperature and Turbidity in Glacially Fed Lake Tekapo,	LAND USE	Aquatic Leeches (Hirudinea) as Bioindicators of Organic Chemical Contaminants in Freshwater
W85-01637 2H	Land Use, Runoff and Recharge on Selected Watersheds in the U.S. Virgin Islands,	Ecosystems,
LAKE TREHORNINGEN	W85-01799 4C	
Lake Trehorningen Restoration Project. Changes in Water Quality after Sediment	Land Use Effects on Sediment Yield and Qual- ity,	LEGAL ASPECTS Legal Aspects of Acidic Precipitation,
D:edging, W85-02097 5G	W85-02060 6G	W85-01669 6E
LAKE VANAJAVESI	LANDFILLS	International Cooperation and Acid Rain Pollu- tion: Establishing the Framework for Control,
Zinc in Water and Sediments of Two Finnish Lakes,	Municipal Solid-Waste Disposal and Ground- Water Quality in a Coastal Environment, West-	W85-01670 6E
W85-02065 5B	Central Florida, W85-01789 5E	State Laws Mandating Water Conservation, W85-01806 6E
LAKE VECHTEN Carbon Flow Across the Sediment-Water Inter-	Hydrogeology and Water Quality of Six Landfill	Tasks of the Dam Keeper (Les Taches du Gar-
face in Lake Vechten, The Netherlands, W85-02066 2H	Sites in Hillsborough County, Florida, W85-01946 5B	dien de Barrage), W85-01859 4A
LAKE WABAMUM	Characteristics of Leachates from Hazardous Waste Landfills,	LEGISLATION
Spatial Heterogeneity in Whole Lake Sediments - Towards a Loading Estimate,	W85-02118 5B	Fishable Waters Everywhere: An Appropriate Goal,
W85-02073 2H	LEACHATES	W85-01850 6B
LAKE WAKATIPU Predominant Headwater Inflow and its Control	Characteristics of Leachates from Hazardous Waste Landfills,	LELYSTAD Design Inflow Intensity and Design Inflow Pro-
of Lake-River Interactions in Lake Wakatipu,	W85-02118 5B	files For Storm Sewers, W85-01692 2E
W85-01638 2H	LEACHING	
Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake	Contribution of Leaching of Diazinon, Parath- ion, Tetrachorvinphos and Triazophos from Glasshouse Soils to Their Concentrations in	LIGHT INTENSITY Effects of the Herbicide Atrazine on an Oyster- Food Organism,
Waramaug, Connecticut,	Water Courses, W85-01961 5B	W85-01808 5C
W85-02093 2H		LIGNOCELLULOSE
LAKE WASHINGTON Seasonal Study of Methane Oxidation in Lake	LEAD Adsorption of Copper, Lead and Cobalt by Ac-	Relative Contributions of Bacteria and Fungi to Rates of Degradation of Lignocellulosic Detri-
Washington, W85-02134 2H	tivated Carbon, W85-01717 5D	tus in Salt-Marsh Sediments, W85-02138 2L

LIMNOLOGY

LIMNOLOGY	LOW FLOW	Levels of the Wilcox-Carrizo and Sparta
Limnology in Reservoirs on the Colorado River, W85-01812 2H	Streamflow Characteristics of the Yellowstone River Basin, Montana, Through September	Aquifers, W85-01785 2F
LINDASPOLLENE	1982, W85-01781 2E	Fluoride, Nitrate, and Dissolved-Solids Concen-
Sedimentation of Organic and Inorganic Particu-	W63-01/61 2E	trations in Ground Waters of Washington,
late Material in Lindaspollene, a Stratified, Land-Locked Fiord in Western Norway.	Effects of the Drought of 1980-81 on Stream- flow and on Ground-water Levels in Georgia,	W85-01828 2F
W85-01767 2L	W85-01783 2E	Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi, April, 1982,
LINEAR PROGRAMMING	LOWER SAXONY	W85-01926 7C
LP Embedded Simulation Model for Conjunc-	Study of Habitat Conditions of the Macrophytic	
tive Use Management Optimization, W85-01801 4B	Vegetation in Selected River Systems in West- ern Lower Saxony (Federal Republic of Germa-	Distribution of Selected Chemical Constituents in Water from the Floridan Aquifer, Southwest
T TATIBLISTS	ny), W85-01887 2H	Florida Water Management District,
LININGS New Materials in Pipe Networks - Special Con-	W63-01007	W85-01928 7C
sideration of Internal Coatings,	LULU LAKE	Hydrologic Maps of the High Plains Aquifer,
W85-01997 2G	Decomposition of Wild Rice (Zizania aquatica) Straw in Two Natural Lakes of Northwestern	January 1981, Southwestern Kansas, W85-01930 7C
Various Coating Materials for Potable Water	Ontario, W85-01647 2H	
Concrete Storage Reservoirs - Experiences in	W65-01047	Altitude of the Top of the Matawan Group- Magothy Formation, Suffolk Country, Long
Germany, Switzerland and Austria, W85-02000 8G	MACROPHYTES	Island, New York,
W83-02000	Study of Habitat Conditions of the Macrophytic	W85-02030 7B
LIPIDS	Vegetation in Selected River Systems in West- ern Lower Saxony (Federal Republic of Germa-	
Annual Cycle of Kepone Residue and Lipid	ny),	Altitude and Generalized Configuration of the
Content of the Estuarine Clam, Rangia cuneata, W85-01844 5C	W85-01887 2H	Top of the Floridan Aquifer, St. Johns County, Florida.
#83-01044	Impact of Acidification and Eutrophication on	W85-02050 7C
LITTER	Macrophyte Communities in Soft Waters. II. Ex-	
Fluxes of Heavy Metals in Delaware River	perimental Studies,	MARINE ENVIRONMENT
Freshwater Tidal Wetlands, W85-01805 5B	W85-01889 5C	Terrestrial Runoff as a Cause of Outbreaks of Acanthaster planci (Echinodermata: Asteroi-
LITTLE POPO AGIE RIVER	MAGNETOMETER True Location and Orientation of Fractures	dea),
Impact of an Oil Field Effluent on Microbial	Logged with the Acoustic Televiewer (Includ-	W85-01893 5C
Activities in a Wyoming River,	ing Programs to Correct Fracture Orientation),	MARINE SEDIMENTS
W85-01640 5C	W85-01780 2F	Man-Made Structures on Marine Sediments: Ef-
LOAD DISTRIBUTION	MALAYSIA	fects on Adjacent Benthic Communities,
Loading Concentration Models for Phosphate in	Case Study of Heavy Rain Spell on 13th-25th	W85-01895 6G
Shallow Lakes,	December 1982 over the East Coast of Peninsu-	Comparison of Sediment Energy-Texture Rela-
W85-02067 2H	lar Malaysia and Singapore, W85-02125 2B	tionships in Marine and Lacustrine Environ-
LOADING CONCENTRATION MODELS		ments, W85-02058 2J
Loading Concentration Models for Phosphate in	MALLARD	W 63-02038
Shallow Lakes, W85-02067 2H	Breeding Mallard (Anas platyrhynchos) Habitat Suitability Model,	MARINE WATER QUALITY
W83-02007 2H	W85-01792 6G	Effects of Runoff from Undeveloped Versus
LOGGING		Lightly Developed Watersheds on Tropical
Logging Impacts and Some Mechanisms that	MANAGEMENT	Planktonic Ecosystem, W85-01810 5C
Determine the Size of Spring and Summer Populations of Caba Salara Francisco	Micro-Electronics in the Water Industry - A Review of Present and Probable Future Devel-	W65-01810
ulations of Coho Salmon Fry (Oncorhynchus kisutch) in Carnation Creek, British Columbia,	opments,	MARSH PLANTS
W85-01919 5C	W85-02008 6A	Fluxes of Heavy Metals in Delaware River
	BAANIAWAWII BEWEE	Freshwater Tidal Wetlands,
Sediment Concentrations from Intensively Pre- pared Wetland Sites.	MANAWATU RIVER Organic Wastewater Effects on Benthic Inverte-	W85-01805 5B
w85-02112 4C	brates in the Manawatu River,	MARYLAND
	W85-01632 5C	State Laws Mandating Water Conservation,
LONDON	MANGANESE	W85-01806 6E
Hydrocarbon Accumulation in Freshwater Sedi-	Manganese Cycle in Lac Leman, Switzerland:	Effects of the Herbicide Atrazine on an Oyster-
ments of an Urban Catchment, W85-02078 5B	The Role of Metallogenium,	Food Organism,
LONG RELAND	W85-02081 2H	W85-01808 5C
LONG ISLAND Geohydrology of the Meadowbrook Artificial-	Flux of Reduced Chemical Constituents	Recent Vertical Accretion Rates at Blackwater
Recharge Project Site in East Meadow, Nassau	(Fe(2+), Mn(2+), NH4(+) and $CH4) $ and $Sedi-$	Wildlife Refuge,
County, New York,	ment Oxygen Demand in Lake Erie, W85-02087 2H	W85-01809 2L
W85-01774 2F	W 63-02087	Poster and California Character of
LOUGH NEAGH	Transport of Iron and Manganese in Relation to	Erosion and Sedimentation Chronology of Three Watersheds in Maryland,
Rates of Sediment-Water Exchange of Oxygen	the Shapes of Their Concentration-Depth Pro-	W85-01835 2J
and Sediment Bioturbation in Lough Neagh,	files, W85-02090 2K	
Northern Ireland,	W 03-02070	Runoff from Utility Waste Landfill to be Recy-
W85-02085 2H	MAPS	cled from Detention Basin to Scrubber Make-
LOUISIANA	Water-Level Changes in the High Plains Re-	Up, W85-01849 5D
Regional Geohydrology of the Northern Louisi-	gional Aquifer, Northwestern Oklahoma, Prede- velopment to 1980,	
ana Salt-Dome Basin, Part III, Potentiometric	W85-01771 2F	Microbial Degradation of 2,4,6-Trichloroaniline
Levels of the Wilcox-Carrizo and Sparta		in Aquatic Samples and Laboratory Enrichment
Aquifers, W85-01785 2F	Regional Geohydrology of the Northern Louisi- ana Salt-Dome Basin, Part III, Potentiometric	Cultures, W85-02120 5B
24	and one-bome band, rait iti, rotentiometric	

MASS TRANSFER Mechanism of Semifluidized Bed Bioreactor for Biological Phenol Degradation,	Organic and Inorganic Mercury Species in the Ft. Lewis Solvent Refined Coal Pilot Plant Water Treatment Process,	MICROBIAL DEGRADATION Microbial Degradation of 2,4,6-Trichloroaniline in Aquatic Samples and Laboratory Enrichment
W85-02106 5D	W85-01798 5D	Cultures,
MASSACHUSETTS	Dissolved and Suspended Mercury Species in	W85-02120 5B
Fate of Trace Organics During Rapid Infiltra- tion of Primary Wastewater at Fort Devens,	the Wabigoon River (Ontario, Canada): Seasonal and Regional Variations,	MICROBIAL STUDIES Impact of an Oil Field Effluent on Microbial
Massachusetts,	W85-02091 5B	Activities in a Wyoming River,
W85-01730 5D	MEROMICTIC LAKES	W85-01640 5C
Evaluation of the Visibility Criterion of the Mas-	Seasonal Meromixis in Three Hypersaline Lakes	MICROCOMPUTER PROGRAMS
sachusetts Sanitary Code for Swimming in Natu- ral Waters,	on Rottnest Island, Western Australia, W85-01645 2H	Integrated Methodology for Instream Flow
W85-01800 6E		Strategies, W85-01951 5B
	METAL COMPLEXING	W63-01931 3B
Water Resources Data, Massachusetts and Rhode Island, Water Year 1982,	Study of the Copper-Complexing Compounds Released by Some Species of Cyanobacteria,	MICROORGANISMS Microorganism Survival in an Ice-Covered
W85-01935 2E	W85-01725 5B	River,
MATHEMATICAL EQUATIONS	METAL TOLERANCE	W85-01708 5B
Darcy's Flow with Variable Permeability: A	Association of Metal Tolerance with Multiple	Fate of epsilon-Caprolactam in the Aquatic En-
Boundary Integral Solution, W85-02165 2F	Antibiotic Resistance of Bacteria Isolated from Drinking Water,	vironment,
	W85-02133 5F	W85-01956 5B
Travel Times from Buried and Surface Infiltra-	METALINAMAN	MICROWAVES
tion Point Sources, W85-02167 2G	METALIMNION Epilimnetic Nutrient Loading by Metalimnetic	Microwave Measurements of Moisture Distribu-
	Erosion and Resultant Algal Responses in Lake	tions in the Upper Soil Profile,
MATHEMATICAL MODELS	Waramaug, Connecticut,	W85-02160 2G
Use of Fixed-Bed Adsorber Models to Predict the Fluxes of Toxic Substances in Groundwaters	W85-02093 2H	MIDMAR DAM
and Soil Environments,	METALLOGENIUM	Vertical Stratification in Sediments from a
W85-01793 5B	Manganese Cycle in Lac Leman, Switzerland:	Young Oligotrophic South African Impound-
Groundwater Response under an Electronuclear	The Role of Metallogenium,	ment: Implications in Phosphorus Cycling,
Plant to a River Flood Wave Analyzed by a	W85-02081 2H	W85-02086 2H
Nonlinear Finite Element Model,	METALS	MIGRATION
W85-02157 2F	Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban	Heavy Metal Migration in Soil-Leachate Sys-
MATTAPONI RIVER	Runoff Program,	tems, W85-01868 5B
Kepone Concentration in Juvenile Anadromous	W85-01661 5A	W 83-01808
Fishes, W85-01847 5B	Metals Distributions in Activated Sludge Sys-	MILL CREEK Availability of Dissolved Oxygen in Interstitial
MAUMEE RIVER	tems,	Waters of a Sandy Creek,
Occurrence of the Asiatic Clam Corbicula flu-	W85-01737 5D	W85-02103 2E
minea in the Maumee River and Western Lake	River Elbe: Processes Affecting the Behaviour	MILLET
Erie, W85-01753 5C	of Metals and Organochlorines During Estuarine Mixing,	Agricultural Droughts at Peddapuram, East Go-
	W85-01836 5B	davari District, Andhra Pradesh,
MEADOWS Phonology and Water Palations of Three Plant	Birra Wasan Bransses Affanting the Behavious	W85-02126 21
Phenology and Water Relations of Three Plant Life Forms in a Dry Tree-Line Meadow,	River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine	MINE DRAINAGE
W85-01892 2I	Mixing,	Effects of Phosphate Fertilizer Applications and
MEASURING INSTREAM USE	W85-01837 5B	Chemistry-Mineralogy of the Iron Oxide System on Phosphate Adsorption-Desorption by Stream
Quantifying the Relative Performance of Alter-	METHANE	Sediments,
native Measures for Fulfilling Instream Uses in	Flux of Reduced Chemical Constituents	W85-01794 5B
the Plains Environment,	(Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-	MINE WASTES
W85-02107 6B	ment Oxygen Demand in Lake Erie, W85-02087 2H	MINES: A Model to Forecast Mine Wastewater
MEASURING INSTRUMENTS		Quality,
Diurnal Variation in the Oxygen Uptake of River Sediments in Vitro by Use of Continuous	Seasonal Study of Methane Oxidation in Lake	W85-01750 5B
Flow-Through Systems,	Washington, W85-02134 2H	Bioavailability of Pb and Zn from Mine Tailings
W85-02069 2E		as Indicated by Erythrocyte delta-Aminolevu-
MELTING	Methane Production in Minnesota Peatlands, W85-02135 2L	linic Acid Dehydratase (ALA-D) Activity in
Ice Cover Melting in a Shallow River,	W85-02135 2L	Suckers (Pisces: Catostomidae), W85-01918 5A
W85-01713 2C	METHYLCYTOSINE	***************************************
MEMBRANE FILTER	Formation of Stable Organic Chloramines During the Aqueous Chlorination of Cytosine	MINERAL SPRINGS
Effect of Noncoliforms on Coliform Detection	and 5-Methylcytosine,	Kinetic Factors of CaCO3-Precipitation and the Partitioning of 12C and 13C. Studies at the Wa-
in Potable Groundwater: Improved Recovery	W85-01726 5F	terfalls of Guterstein and Urach (Schwabische
with an Anaerobic Membrane Filter Technique, W85-02140 5F	MEUSE RIVER	Alb) (Kinetische Faktoren der CaCO3-Abschei-
	Quality Aspects of the Biesbosch Reservoirs,	dung und der Fraktionierung von 12C und 13C. Untersuchungen an den Wasserfallen von Guter-
MEMBRANE PROCESSES	W85-01979 5G	stein und Urach (Schwabische Alb)),
Biological Fouling of Reverse Osmosis Mem- branes,	MICHIGAN	W85-01662 1B
W85-01977 5D	Ann Arbor Controls Trihalomethanes,	MINERALIZATION
MERCURY	W85-01911 5F	Effect of Substrate Concentration and Organic
Mechanisms of Metal Adsorption from Aqueous	Estimates of Dissolved and Suspended Sub-	and Inorganic Compounds on the Occurrence
Solutions by Waste Tyre Rubber,	stance Yield of Stream Basins in Michigan,	and Rate of Mineralization and Cometabolism,
W85-01724 5D	W85-01942 5A	W85-02132 5B

SUBJECT INDEX

MINING IMPACTS

MINING IMPACTS Potential Effects of Surface Coal Mining on the Hydrology of the Bloomfield Coal Tract,	Synthetic Design Storm and its Relation to In- tensity-Duration Frequency Curves, W85-01679 2B	Use of Models for Water Resources Manage- ment, Planning, and Policy, W85-02146 6A
Dawson County, Eastern Montana,	W 83-01079 2D	W 63-02140
W85-01791 2F	Statistical Methods of Storm Analysis, W85-01680 2B	Descriptive Decision Process Model for Hierar- chical Management of Interconnected Reservoir
MINNESOTA	Some Statistical Properties of Short-Duration	Systems, W85-02147 4A
Waste Management Scenarios for Minnesota's	Rainfall,	W85-02147 4A
Twin Cities, W85-01867 5E	W85-01681 2B	MONITORING
W85-01867 5E		Preliminary Findings of the Priority Pollutant
Appraisal of Water from Surficial-Outwash	Stochastic Characterization of Temporal Storm	Monitoring Project of the Nationwide Urban
Aquifers in Todd County and Parts of Cass and	Patterns, W85-01686 2B	Runoff Program,
Morrison Counties, Central Minnesota,		W85-01661 5A
W85-02038 4B	Modeling Estuarine Nutrient Geochemistry in a	Hepatic Mixed-Function Oxidases in California
MIRES	Simple System, W85-01702 2L	Flatfishes are Increased in Contaminated Envi-
Vegetation and Water Chemistry of Four Oligo-	W65-01702 2D	ronments and by Oil and PCB Ingestion,
trophic Basin Mires in Northwestern Ontario,	Stochastic Description of Temporal Daily Rain-	W85-01894 5A
W85-01648 2H	fall Patterns,	New Instrumentation in Automatic Water Qual-
MISSISSIPPI	W85-01712 2B	ity Monitoring,
Drought in Southeastern United States,	Modelling Criteria for Bubble Plumes - A Theo-	W85-02007 5G
W85-01642 2B	retical Approach,	Automated Course Customs for Water Barange
	W85-01715 8B	Automated Sensor Systems for Water Resource Pollution Warning and Treatment Process Con-
Water-Level Maps of the Alluvial Aquifer,	Modeling Algal Behaviour in the River Thames,	trol,
Northwestern Mississippi, April, 1982, W85-01926 7C	W85-01720 5G	W85-02010 5F
	Metals Distributions in Activated Sludge Sys-	MONTANA
Water-Level Maps of the Alluvial Aquifer in	tems.	Statistical Analysis and Evaluation of Water-
Northwestern Mississippi, April 1983, W85-01944 7C	W85-01737 5D	Quality Data for Selected Streams in the Coal
W85-01944		Area of East-Central Montana,
Selected Bibliography of Water Resources Pub-	Predicting Variability in a Lake Ontario Phos- phorous Model.	W85-01770 5E
lications for Mississippi,	W85-01758 2H	Water Resources of the Fort Union Coal
W85-02033 10C	W 65-01756 211	Region, East-Central Montana,
MISSISSIPPI RIVER	Computer Program and Data Listing for Two-	W85-01772 2F
Heavy Metals in the Lower Mississippi River,	Dimensional Ground-Water Model for Laramie	
W85-01744 5B	County, Wyoming,	Streamflow Characteristics of the Yellowstone River Basin, Montana, Through September
	W85-01787 7C	1982.
MITTELGEBIRGE MOUNTAINS Calculation of Melt-water Discharge from the	LP Embedded Simulation Model for Conjunc-	W85-01781 2E
Snow Cover in Catchment Areas in the Mittel-	tive Use Management Optimization,	
gebirge Mountains (Berechnung der Schmelz-	W85-01801 4B	Potential Effects of Surface Coal Mining on the
wasserabgabe aus der Schneedecke in Einzugs-	Daily Water and Sediment Discharges from Se-	Hydrology of the Bloomfield Coal Tract Dawson County, Eastern Montana,
gebieten des Mittelgebirges),	lected Rivers of the Eastern United States: A	W85-01791 2F
W85-01972 2C	Time-Series Modeling Approach,	
MIXED-FUNCTION OXIDASES	W85-01823 2J	Potential Effects of Surface Coal Mining on the
Hepatic Mixed-Function Oxidases in California	Use of a Model to Assess Factors Affecting the	Hydrology of the Corral Creek Area, Hanging
Flatfishes are Increased in Contaminated Envi-	Oxygen Balance in the Water of the Dollard,	Woman Creek Coal Field, Southeastern Montana,
ronments and by Oil and PCB Ingestion,	W85-01839 2L	W85-02040 51
W85-01894 5A	Calibratian Wasse Control Madala	W 03-020-10
MIXING	Calibrating Water System Models, W85-01904 5F	MUDFLOWS
One-Dimensional Mixing and Flushing Model of	W 85-01504	Mechanics of Mudflows,
the Ems-Dollard Estuary: Calculation of Time	Three-Dimensional Digital-Computer Model of	W85-01816 8I
Scales at Different River Discharges,	the Principal Ground-Water Reservoir of the	MULTIRESERVOIR NETWORKS
W85-01838 2L	Sevier Desert, Utah, W85-01925 7C	Descriptive Decision Process Model for Hierar
The of a Madalan Assess To a second of	W83-01923	chical Management of Interconnected Reservoi
Use of a Model to Assess Factors Affecting the Oxygen Balance in the Water of the Dollard,	Flood-Frequency Estimates for Five Gaged	Systems,
W85-01839 2L	Basins in Wichita, Kansas,	W85-02147 4A
25	W85-01949 2A	MULTIVARIATE ANALYSIS
MIXING ZONE	Basic Concepts of Kinematic-Wave Models,	Univariate Versus Multivariate Rainfall Statis
Mixing Zone Studies in the Grand River Basin,	W85-02035 2A	tics - Problems and Potentials,
W85-01710 5B		W85-01685 21
MODEL STUDIES	Calibration and Verification of a Rainfall-Runoff	MUNICIPAL WASTE
Nonsteady-State-Biofilm Process for Advanced	Model and a Runoff-Quality Model for Several Urban Basins in the Denver Metropolitan Area,	Wastewater Treatment with Aerated Submerge
Organics Removal,	Colorado.	Biological Filters,
W85-01658 5D	W85-02044 2A	W85-01736 5I
Stochastic Model for BOD and DO in Streams		MUNICIPAL WASTEWATER
When the Velocity is Random and Distance-	Mass Balance Models of Phosphorus in Sedi-	Study Cases of Operative Conditions of Munic
Dependent,	ments and Water, W85-02071 2J	pal Treatment by Lagooning (Etude des Cond
W85-01676 5B	11 00-020/1	tions de Fonctionnement et d'Exploitation d
	Dynamic Phosphate Budget Model for a Eutro-	Quelques Cas Concrets de Traitement d'Eau
Review of Rainfall Data Application for Design	phic Lake,	Residuaires Urbaines par Lagunage),
and Analysis, W85-01677 2B	W85-02072 2H	W85-01976 51
	Transport of Iron and Manganese in Relation to	MUR RIVER
Design Storm for a Tropical Location with Lim-	the Shapes of Their Concentration-Depth Pro-	Weinzodl Power Station on the Mur (Da
ited Data,	files,	Kraftwerk Weizodl an der Mur),
W85-01678 2B	W85-02090 2K	W85-01860 8.

MUSSELS Mytilus galloprovincialis and Parapen	naeus lon-	Carbon Flow Across the Sediment-Water Interface in Lake Vechten, The Netherlands,	r- Estimation of Natural Streamflow in the Jemez River at the Boundaries of Indian Lands, Central
girostris as Bioindicators of Heavy M Organochlorine Pollution,	Metal and	W85-02066 21	H New Mexico, W85-02048 2E
W85-01899	5A	Dynamic Phosphate Budget Model for a Eutro	•
Spatial and Temporal Trends in Hea	vv Metal	phic Lake, W85-02072	NEW YORK H Geohydrology of the Meadowbrook Artificial-
Concentrations in Mussels from North			Recharge Project Site in East Meadow, Nassau
land Coastal Water, W85-01901	5A	Available Phosphorus in Lake Sediments in th Netherlands,	County, New York,
		W85-02092 21	I Committee of the comm
Changes in the Naiad Fauna of the Cu River below Lake Cumberland in Cer		NETSTAL	Major Institutional Arrangements Affecting Ground Water in New York State,
tucky,		Hydroelectric Power Station at the Netstal Lim	IC W85.01802 6E
W85-01921	6G	Factory (Das Wasserkraftwerk der Kalkfabri Netstal AG),	
MUTAGENIC ACTIVITY			A Short-Term Changes in the Base Neutralizing Capacity of an Acid Adirondack Lake, New
Formation and Removal of Mutagenic During Drinking Water Preparation,	c Activity	NEUSIEDLERSEE	York,
W85-01728	5F	Phosphate Adsorption Kinetics of Resuspende	
Study of Mutagenic Activity in Water	r in a Pro-	Sediments in a Shallow Lake, Neusiedlerse Austria,	Annuace of the Top of the Matawan Group-
gressive Ozonation Unit (Etude du	Caractere		H Magothy Formation, Suffolk Country, Long Island, New York,
Mutagene de l'Eau dans une Filiere d	le Produc-	NEVADA	W85-02030 7B
tion a Ozonation Estagee), W85-01987	5F	Geohydrologic Data for Test Well USW G-	4, Floods of August 7-8, 1979, in Chautauqua
	2	Yucca Mountain Area, Nye County, Nevad	County, New York, with Hydraulic Analysis of
MYRIOPHYLLUM Toxicity of Chlorine to a Common	Vascular	W85-02031 7	Canadaway Creek in the Village of Fredonia,
Aquatic Plant,		Flood Potential of Fortymile Wash and its Pri cipal Southwestern Tributaries, Nevada Te	
W85-01731	5C	Site, Southern Nevada,	Partitioning of Phosphorus Between Particles
NANNOCHLORIS OCULATA		W85-02037	and Water in a River Outflow, W85-02075 2H
Effects of the Herbicide Atrazine on a Food Organism,	an Oyster-	NEVADA TEST SITE	
W85-01808	5C	Flood Potential of Fortymile Wash and its Pri	
NARRAGANSETT BAY		cipal Southwestern Tributaries, Nevada Te Site, Southern Nevada,	Oligotrophic Lake Sediments,
Urban Runoff as a Source of Polyc	yclic Aro-		2E W85-02076 2J
matic Hydrocarbons to Coastal Waters W85-02108	s, 5B	NEW DEHLI	NEW ZEALAND
	38	Distribution and Periodicity of Total, Faco	organic Wastewater Effects on Benthic Inverte-
NATURAL RECHARGE Land Use, Runoff and Recharge of	n Calcoted	Coliform Bacteria in an Aquatic Ecosystem, W85-01675	brates in the Manawatu River, 5B W85-01632 5C
Watersheds in the U.S. Virgin Islands,			
W85-01799	. 4C	NEW DELHI Influence of Physico-Chemical Factors on t	Groundwater Quality Survey of an Unsewered, Semi-Rural Area,
NATURAL WATERS		Coliform Bacteria in a Closed-Lake Wat	
Singlet Oxygen in Surface Waters - F	Part I: Fur-	System,	Water Quality of the Waiohewa Stream, Ro-
furyl Alcohol as a Trapping Agent, W85-01964	2K		torua,
		NEW HAMPSHIRE Potential for Acidification of Six Remote Pon	W85-0163-\
Singlet Oxygen in Surface Waters Quantum Yields of Its Production by		in the White Mountains of New Hamphire,	Nitrogen and Phosphorus in the Ngongotaha
ural Humic Materials as a Function		W85-01834	5B Stream, W85-01635 5B
length, W85-01965	2K	Water Resources Data, New Hampshire a	nd
		Vermont, Water Year 1982,	Critical Depths for Passage in Braided Rivers, Canterbury, New Zealand,
Simultaneous Concentration of Four uses from Tap, Waste, and Natural Waste,			W85-01636 2E
W85-02137	5A	NEW JERSEY Fluxes of Heavy Metals in Delaware Riv	ver Water Temperature and Turbidity in Glacially
NAVIGABLE WATERWAYS		Freshwater Tidal Wetlands,	Fed Lake Tekapo,
Fishable Waters Everywhere: An A	Appropriate		5B W85-01637 2H
Goal, W85-01850	6B	Tidal and Seasonal Variations of Sulfate Ion is	n a Predominant Headwater Inflow and its Control
	-	New Jersey Marsh System,	of Lake-River Interactions in Lake Wakatipu, 5B W85-01638 2H
NETHERLANDS Design Inflow Intensity and Design I	Inflow Pro-	W85-01848	
files For Storm Sewers,		NEW MEXICO	Drought Effect on High-Altitude Forests, Rua-
W85-01692	2E	Water-Use Production Functions of Select Agronomic Crops in Northwestern N	
Release of Sediment-Phosphorus and		Mexico, Phase II,	NOONGOTALIA CEREAM
ence of Algal Growth on This Proces W85-01761	ss, 2H	W85-01817	Nitrogen and Phosphorus in the Ngongotaha
		Instrumentation Used for Hydraulic Testing	
Changes in the Fish Fauna of the Fe velingen Estuary, before and after the		Potential Water-Bearing Formations at Waste Isolation Pilot Plant Site in Southeaste	
1971,	- Orosate ill	New Mexico,	NICE
W85-01765	6G	W85-01827	7B Nice on the French Riviera - the Birthplace of Drinking Water Treatment with Ozone (Nice,
Impact of Acidification and Eutrop		Annual Water-Resources Review, White San	nds sur la Riviera Française - Berceau du Traitement
Macrophyte Communites in Soft Wa	ters. II. Ex-	Missile Range, New Mexico, 1982,	de l'Eau par l'Ozone), 2E W85-01988 5F
perimental Studies, W85-01889	5C		
		Data for Ground-Water Studies of the San June New Maries (1982 82)	uan NIGER RIVER Earth Foundation Treatment at Jebba Dam Site,
Quality Aspects of the Biesbosch W85-01979	Keservoirs, 5G	Basin, New Mexico (1982-83), W85-02034	7C W85-01871 8D

NIGERIA Earth Foundation Treatment at Jebba Dam Site, W85-01871 8D	NORTHERN GREAT PLAINS Machine-Readable Data Files from the Madison Limestone and Northern Great Plains Regional	Effects of Phosphate Fertilizer Applications and Chemistry-Mineralogy of the Iron Oxide System on Phosphate Adsorption-Desorption by Stream
NILE RIVER Effects of Sedimentation on the Storage Capac-	Aquifer System Analysis Projects, Montana, Ne- braska, North Dakota, South Dakota, and Wyo- ming.	Sediments, W85-01794 5B
ity of the High Aswan Dam Reservoir, W85-02101 4A	W85-01790 7C	Chemical Study of the Interstitial Water Dis- solved Organic Matter and Gases in Lake Erie,
NITRATE Fluoride, Nitrate, and Dissolved-Solids Concen-	NORTHERN IRELAND Spatial and Temporal Trends in Heavy Metal	Cleveland Harbor, and Hamilton Harbour Bottom Sediments-Composition and Fluxes to
trations in Ground Waters of Washington, W85-01828 2F	Concentrations in Mussels from Northern Ire- land Coastal Water, W85-01901 5A	Overlying Waters, W85-01814 5B
Use of Artifical Wetlands to Remove Nitrogen		Trophic Ecology of Fish Rearing Ponds,
Compounds from Wastewater, W85-01978 5D	Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh, Northern Ireland,	W85-01833 2H
NITRATES	W85-02085 2H	Ground-Water Hydrology and Quality before and after Strip Mining of a Small Watershed in
Origin of Nitrates in Groundwater of the Bunz Valley (Woher stammen die Nitrate im Grun-	NORTHWEST TERRITORIES Microorganism Survival in an Ice-Covered	Jefferson County, Ohio, W85-01943 4C
waster des Bunztales),	River,	OIL POLLUTION
W85-01856 5B	W85-01708 5B	Hepatic Mixed-Function Oxidases in California
Observations from the Test Operation of an Ion- exchange Facility for Nitrate Removal in Drink- ing-water Treatment (Erfahrungen aus dem Er-	NORWAY Norwegian Activities on Collection and Re-	Flatfishes are Increased in Contaminated Envi- ronments and by Oil and PCB Ingestion, W85-01894 5A
probengsbetrieb einer Ionenaustauscheranlage	search on Rainfall Data, W85-01691 2B	OIL SPILLS
zur Nitratelimination in der Trinkwasseraufber- eitung), W85-01974 5F	Sedimentation of Organic and Inorganic Particu- late Material in Lindaspollene, a Stratified,	Oil Spill Focuses Attention on the Problems of a Man-Made Recreational Lake,
Distribution of Nitrates in the Potable Waters of	Land-Locked Fjord in Western Norway, W85-01767 2L	W85-01650 5B
Sri Lanka,		OIL WASTES *OIL FIELDS Impact of an Oil Field Effluent on Microbial
W85-02015 5B NITRIFICATION	Environmental and Biochemical Investigation of Some Effects of Organic Pollution in Inner Os- lofford, Norway.	Activities in a Wyoming River, W85-01640 5C
Experimental Measurement of Sediment Nitrifi-	W85-01896 5C	
cation and Denitrification in Hamilton Harbour, Canada.	NUTRIENT LOADING	OKLAHOMA Water-Level Changes in the High Plains Re-
W85-02070 2H	Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake	gional Aquifer, Northwestern Oklahoma, Predevelopment to 1980,
NITROGEN	Waramaug, Connecticut,	W85-01771 2F
Nitrogen and Phosphorus in the Ngongotaha Stream,	W85-02093 2H	Hydrology of an Abandoned Coal-Mining Area
W85-01635 5B	NUTRIENT LOADINGS Spatial Heterogeneity in Whole Lake Sediments	near McCurtain, Haskell County, Oklahoma, W85-02041 5B
Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control,	- Towards a Loading Estimate, W85-02073 2H	OLIGOTROPHIC LAKES
W85-01655 5D	NUTRIENTS	Vegetation and Water Chemistry of Four Oligo- trophic Basin Mires in Northwestern Ontario,
Role of Sediments in the Nitrogen Budget of Lower Green Bay, Lake Michigan, W85-01754 5B	Decomposition of Wild Rice (Zizania aquatica) Straw in Two Natural Lakes of Northwestern Ontario.	W85-01648 2H Microbial Metabolism in Surface Sediments and
Limnology in Reservoirs on the Colorado River,	W85-01647 2H	its Role in the Immobilization of Phosphorus in
W85-01812 2H	Modeling Estuarine Nutrient Geochemistry in a Simple System,	Oligotrophic Lake Sediments, W85-02076
Use of Artifical Wetlands to Remove Nitrogen Compounds from Wastewater,	W85-01702 2L	Vertical Stratification in Sediments from a Young Oligotrophic South African Impound-
W85-01978 5D	Limnology in Reservoirs on the Colorado River, W85-01812 2H	ment: Implications in Phosphorus Cycling,
NORFOLK Pump Station Design: The Benefits of Computer	Fate of epsilon-Caprolactam in the Aquatic En-	W85-02086 2H
Modeling, W85-01905 8C	vironment,	ON-SITE DISPOSAL Restoration of Failing On-Site Wastewater Dis
The state of the s	W85-01956 5B	posal Systems Using Water Conservation,
NORTH CAROLINA Drought in Southeastern United States,	Influence of Within-Stream Disturbance on Dis- solved Nutrient Levels During Spates,	W85-01656 5D ONTARIO
W85-01642 2B	W85-02089 2E	Decomposition of Wild Rice (Zizania aquatica
Effects of Channel Excavation on Water-Quality Characteristics of the Black River and on Ground-Water Levels near Dunn, North Caroli-	Summer Peak of Nutrient Concentrations in Lake Water, W85-02098 5B	Straw in Two Natural Lakes of Northwestern Ontario, W85-01647 21
na,	23,543,4	
W85-01924 2A Integrated Methodology for Instream Flow	OCEAN DUMPING Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico.	Vegetation and Water Chemistry of Four Oligo trophic Basin Mires in Northwestern Ontario W85-01648
Strategies,	W85-01963 5E	
	OCHLOCKONEE BAY	Mixing Zone Studies in the Grand River Basin W85-01710
NORTH DAKOTA Guide to North Dakota's Ground-Water Re-	Modeling Estuarine Nutrient Geochemistry in a Simple System,	Beach Fecal Coliforms,
sources, W85-01824 2F	W85-01702 2L	W85-01711 51
	OHIO	Morphology and Recent Sediments of th
Water Resources Data, North Dakota, Water Year 1982,	Oil Spill Focuses Attention on the Problems of a Man-Made Recreational Lake,	Lower Anastomosing Reaches of the Attawapis kat River, James Bay, Ontario, Canada,
W85-01936 2E	W85-01650 5B	W85-01734 2

2Ј

Phytoplankton Population Dynamics of a Small Reservoir: Effect of Intermittent Mixing on Phy-	Removal of Volatile Organic Pollutants from Rapid Streams,	OXIDANTS Determination of Oxidants Formed upon the
toplankton Succession and the Growth of Blue- green Algae,	W85-01738 5B	Disinfection of Drinking Water with Chlorine Dioxide.
W85-01916 2H	Toxicity of Organic Mixtures Saturated in Water to Daphnia magna. Effect of Compositional	W85-01743 5A
Physical and Geochemical Characteristics of	Changes,	OXIDATION
Suspended Solids, Wilton Creek, Ontario, W85-02056 2H	W85-01953 5C	Investigation of Photocatalytic Oxidation for Wastewater Cleanup and Reuse,
Whole-Lake Lead Burdens in Sediments of	Identification of Nonionic Detergents by GC/	W85-01813 5D
Lakes in Southern Ontario, Canada, W85-02062 5B	CI-MS: I. A Complementary Method or an At- tractive Alternative to GC/EI-MS and Other	Dynamics and Mechanisms of Arsenite Oxida-
Historical Changes in Anthropogenic Lead Fall-	Methods, W85-01955 5A	tion by Freshwater Lake Sediments, W85-02080 5B
out in Southern Ontario, Canada, W85-02063 5B	Biodegradability Testing of Poorly Water Solu-	Seasonal Study of Methane Oxidation in Lake Washington,
	ble Compounds,	W85-02134 2H
Experimental Measurement of Sediment Nitrifi- cation and Denitrification in Hamilton Harbour,	W85-01957 5B Aquatic Leeches (Hirudinea) as Bioindicators of	OXYGEN
Canada, W85-02070 2H	Organic Chemical Contaminants in Freshwater	Singlet Oxygen in Surface Waters - Part I: Fur- furyl Alcohol as a Trapping Agent,
Dissolved and Suspended Mercury Species in	Ecosystems, W85-01958 5A	W85-01964 2K
the Wabigoon River (Ontario, Canada): Seasonal and Regional Variations,	Prediction of Ecotoxicological Behaviour of	Singlet Oxygen in Surface Waters - Part II:
W85-02091 5B	Chemicals: Relationship between n-Octanol/ Water Partition Coefficient and Bioaccumula-	Quantum Yields of Its Production by Some Nat- ural Humic Materials as a Function of Wave-
OPEN CHANNEL FLOW	tion of Organic Chemicals by Alga Chlorella,	length,
Basic Concepts of Kinematic-Wave Models, W85-02035 2A	W85-01959 5B	W85-01965 2K
	Method for Total Organic Chlorine Determina-	Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh.
OPERATING POLICIES Status of Research and Development in Water	tion in Bleach Plant Recipient Waters, W85-01962 5A	Northern Ireland, W85-02085 2H
Supply Systems in India, W85-01982 3D	Volatile Organic Inputs from an Ocean Outfall	
	Near Barceloneta, Puerto Rico,	OXYGEN DEPLETION Oxygen Depletion in Central and Eastern Lake
OPTICAL PROPERTIES Spectral Attenuation and Irradiance in the Lau-	W85-01963 5E	Erie: Relationship with Bacteria, Chlorophyll, POC, and Morphometry,
rentian Great Lakes, W85-01757 2H	Analysis of Aquatic Toxicity Data: Water Solubility and Acute LC50 Fish Data,	W85-01752 2H
OPTIMAL CONTROL	W85-01966 5C	Dependence of Hypolimnetic Oxygen Consump-
Competition Versus Optimal Control in Ground-	S-L-Lillian of Orangia Minteress in Water	tion on Ambient Oxygen Concentration: Fact or
water Pumping when Demand is Nonlinear, W85-02141 4B	Solubility of Organic Mixtures in Water, W85-02109 5B	Artifact, W85-02149 2H
	Comparison of the Carcinogenic Risks from Fish	OXYGEN UPTAKE
OPTIMIZATION LP Embedded Simulation Model for Conjunc-	vs. Groundwater Contamination by Organic Compounds,	Diurnal Variation in the Oxygen Uptake of
tive Use Management Optimization, W85-01801 4B	W85-02110 5C	River Sediments in Vitro by Use of Continuous Flow-Through Systems,
OREGON	ORGANIC SOILS	W85-02069 2E
Prediction of Peak Flows for Culvert Design on	Coagulation and Restabilization of Particulate,	OYSTERS
Small Watersheds in Oregon, W85-01820 4A	Macromolecular and Protected Organic Aqua- sols by Aluminum (III),	Uptake of Kepone from Sediment Suspensions and Subsequent Loss by the Oyster Crassostrea
	W85-02105 5F	virginia,
Association of Metal Tolerance with Multiple Antibiotic Resistance of Bacteria Isolated from	OSAKA BAY	W85-01897 5B
Drinking Water,	Behavior of Organically-Bound Iron in Seawater	OZONATION
W85-02133 5F	of Estuaries,	Formation and Removal of Mutagenic Activity
ORGANIC CARBON	W85-01913 2L	During Drinking Water Preparation, W85-01728 5F
Oxygen Depletion in Central and Eastern Lake	OSLOFJORD	
Erie: Relationship with Bacteria, Chlorophyll, POC, and Morphometry,	Environmental and Biochemical Investigation of Some Effects of Organic Pollution in Inner Os-	All About Ozone - Its Advantages and Disadvantages in Treating Water,
W85-01752 2H	lofjord, Norway, W85-01896 5C	W85-01986 5F
Transport of Dissolved Organic Carbon through	W85-01896	Study of Mutagenic Activity in Water in a Pro-
a Major Creek of the North Inlet Ecosystem, W85-01766 2L	OTTAWA RIVER	gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc-
	Beach Fecal Coliforms, W85-01711 5B	tion a Ozonation Estagee),
ORGANIC CHLORAMINES Formation of Stable Organic Chloramines	W63-01/11 3B	W85-01987 5F
During the Aqueous Chlorination of Cytosine	Sedimentation in Fluvial and Lacustrine Envi- ronments.	Nice on the French Riviera - the Birthplace of
and 5-Methylcytosine, W85-01726 5F	W85-02057 2J	Drinking Water Treatment with Ozone (Nice, sur la Riviera Francaise - Berceau du Traitement
ORGANIC COMPOUNDS	OVERFLOW	de l'Eau par l'Ozone), W85-01988 5F
Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban	Overflow Data of Rainwater Discharge Systems Determined From Run Off Simulation of Plu-	Ozonation and Activated Carbon Filtration: a
Runoff Program,	viograph Records,	Critical Evaluation,
W85-01661 5A	W85-01698 2E	W85-02019 5F
Fate of Trace Organics During Rapid Infiltra-	Methods For Calculation of Annual and Ex- treme Overflow Events From Combined Sewer	PAMUNKEY RIVER Kepone Concentration in Juvenile Anadromous
tion of Primary Wastewater at Fort Devens, Massachusetts,	Systems,	Fishes,
W85-01730 5D	W85-01699 2E	W85-01847 5B

PAN EVAPORATION

AN EVAPORATION Water Hyacinth Canopy and Pan Evaporation,	PEAK FLOWS Prediction of Peak Flows for Culvert Design on	PHENOLS Determination of 4-Aminophenol in Water by
W85-02128 4A	Small Watersheds in Oregon, W85-01820 4A	High-Performance Liquid Chromatography with Fluorescence Detection,
ARIS	PEAT	W85-01746 5A
General Strategy for Security in Water Supply, W85-01990 5G	Methane Production in Minnesota Peatlands, W85-02135 2L	Mechanism of Semifluidized Bed Bioreactor for
Towards Total Automation of Water Distribu-		Biological Phenol Degradation,
tion (Vers l'Automatisation Integrale dans la	PEAT BOGS Vegetation and Water Chemistry of Four Oligo-	W85-02106 5D
Distribution d'Eau), W85-02009 6A	trophic Basin Mires in Northwestern Ontario, W85-01648	Determination of Phenols in Water Using Raman Spectroscopy,
PARTICLE SIZE		W85-02114 5A
Flocculation Model Testing: Particle Sizes in a	PEDDAPURAM Agricultural Droughts at Peddapuram, East Go-	PHOSPHATE
Softening Plant,	davari District, Andhra Pradesh,	Loading Concentration Models for Phosphate in
W85-01908 5F	W85-02126 2I	Shallow Lakes,
Particle Size Distribution and Chemical Param-	PEE DEE RIVER	W85-02067 2H
eters of the Sediments of a Shallow Turbid Impoundment.	226Ra and 228Ra in the Mixing Zones of the Pee	PHOSPHATE ADSORPTION
W85-02082 2H	Dee River-Winyah Bay, Yangtze River and Delaware Bay Estuaries,	Effects of Phosphate Fertilizer Applications and
	W85-01912 2L	Chemistry-Mineralogy of the Iron Oxide System
PARTICULATE MATTER Sedimentation of Organic and Inorganic Particu-	DESIGNATIVA DI SALITA VICTA	on Phosphate Adsorption-Desorption by Stream
late Material in Lindaspollene, a Stratified,	PENINSULAR MALAYSIA Case Study of Heavy Rain Spell on 13th-25th	Sediments, W85-01794 5B
Land-Locked Fjord in Western Norway,	December 1982 over the East Coast of Peninsu-	W05-01174
W85-01767 2L	lar Malaysia and Singapore,	PHOSPHATE BUDGET
Partitioning of Phosphorus Between Particles	W85-02125 2B	Dynamic Phosphate Budget Model for a Eutro-
and Water in a River Outflow,	PENSACOLA	phic Lake, W85-02072 2H
W85-02075 2H	Irrigation of Public Use Areas by Land Applica- tion of Combined Industrial and Domestic	
PARTICULATES	Waste Effluent.	PHOSPHATES
Improved Operational Control of Sedimentation	W85-01740 5D	Phosphate Adsorption Kinetics of Resuspended Sediments in a Shallow Lake, Neusiedlersee,
Facilities Through the Use of Fiberoptic Sensors (Verbesserte Betriebskontrolle von Sedimenta-	PERMEABILITY	Austria,
tionsanlagen durch Nutzung faseroptischer Sen-	Measurement of Concrete Permeability,	W85-02079 2H
soren),	W85-01714 8F	Makaine & Dalam & Salima Dania
W85-01882 5D	Heavy Metal Migration in Soil-Leachate Sys-	Mechanisms for Release of Sediment-Bound Phosphate to Water and the Effects of Agricul-
Mechanisms for Release of Sediment-Bound	tems,	tural Land Management on Fluvial Transport of
Phosphate to Water and the Effects of Agricul-	W85-01868 5B	Particulate and Dissolved Phosphate,
tural Land Management on Fluvial Transport of Particulate and Dissolved Phosphate,	Darcy's Flow with Variable Permeability: A	W85-02095 5B
W85-02095 5B	Boundary Integral Solution,	PHOSPHORUS
	W85-02165 2F	Nitrogen and Phosphorus in the Ngongotaha
PARTITION COEFFICIENTS Simultaneous Determination of Partition Coeffi-	PESTICIDE RESIDUES	Stream,
cients and Acidity Constants of Chlorinated	Chemical Derivatization Analysis of Pesticide Residues. VIII. Analysis of 15 Chlorophenols in	W85-01635 5B
Phenols and Guaiacols by Gas Chromatography,	Natural Water by In Situ Acetylation,	Growth of Cladophora glomerata in a River
W85-02115 5A	W85-02113 5A	Receiving Sewage Effluent,
PATH OF POLLUTANTS	PESTICIDE TOXICITY	W85-01723 5C
Mixing Zone Studies in the Grand River Basin,	Acute Toxicity of Kepone to Selected Freshwa-	Predicting Variability in a Lake Ontario Phos-
W85-01710 5B	ter Fishes,	phorous Model,
Trace Metal Concentrations of the Waters of a	W85-01846 5C	W85-01758 2H
South Indian River, W85-01751 SB	PESTICIDES	Release of Sediment-Phosphorus and the Influ-
	Quantitative Determination of ppb Levels of Carbamate Pesticide in Water by Capillary Gas	ence of Algal Growth on This Process,
Heavy Metals in Ulva lactuca Collected within Tolo Harbour, An Almost Landlocked Sea.	Chromatography,	W85-01761 2H
W85-01762 5B	W85-01747 5A	Limnology in Reservoirs on the Colorado River,
	Determination of Aldicarb and its Derivatives in	W85-01812 2H
Use of Fixed-Bed Adsorber Models to Predict the Fluxes of Toxic Substances in Groundwaters	Groundwaters by High-Performance Liquid	Phoenhouse Distribution in Codiment of the
and Soil Environments,	Chromatography with UV Detection, W85-01748 5A	Phosphorus Distribution in Sediments of the Delaware River Estuary,
W85-01793 5B		W85-01843 2L
River Elbe: Processes Affecting the Behaviour	Pesticide and PCB Levels in Fish from Alberta	At the Manual Production of the state of the
of Metals and Organochlorines During Estuarine	(Canada). W85-01954 5A	Algal-Availability of Particulate Phosphorus from Diffuse and Point Sources in the Lower
Mixing,		Great Lakes Basin,
W85-01836 5B	Contribution of Leaching of Diazinon, Parath- ion, Tetrachorvinphos and Triazophos from	W85-02061 2K
Zinc in Water and Sediments of Two Finnish	Glasshouse Soils to Their Concentrations in	Mass Balance Models of Phosphorus in Sedi
Lakes, W85-02065 5B	Water Courses,	ments and Water,
	W85-01961 5B	W85-02071 2.
Analysis of Total Phosphorus Transport in	Pesticides in Groundwater Beneath the Central	Analysis of Total Phosphorus Transport in
River Systems, W85-02074 2E	Sand Plain of Wisconsin, W85-02025 5B	River Systems,
		W85-02074 21
Contaminant Transport in Fractured Porous Media: Analytical Solution for a Two-Member		Partitioning of Phosphorus Between Particle
Decay Chain in a Single Fracture,	Phenology and Water Relations of Three Plant Life Forms in a Dry Tree-Line Meadow,	and Water in a River Outflow,
W85-02170 5B		W85-02075

Microbial Metabolism in Surface Sediments and	Effects of the Herbicide Atrazine on Adenine	Irrigated Agricultural Expansion Planning in
its Role in the Immobilization of Phosphorus in Oligotrophic Lake Sediments,	Nucleotide Levels in Zostera marina L. (Eel- grass),	Developing Countries: Resilient System Design, W85-02144 6A
W85-02076 2J	W85-01888 5C	
Vertical Stratification in Sediments from a	PIEDMONT	Use of Models for Water Resources Manage-
Young Oligotrophic South African Impoundment: Implications in Phosphorus Cycling,	Effect of Clear-Cut Silviculture on Dissolved Ion Export and Water Yield in the Piedmont.	ment, Planning, and Policy, W85-02146 6A
W85-02086 2H	W85-02171 5B	PLANT PHYSIOLOGY
Benthic Phosphorus Regeneration in the Poto-	PILES CREEK MARSH	Phenology and Water Relations of Three Plant
mac River Estuary,	Tidal and Seasonal Variations of Sulfate Ion in a	Life Forms in a Dry Tree-Line Meadow, W85-01892 21
W85-02088 2L	New Jersey Marsh System, W85-01848 5B	-
Available Phosphorus in Lake Sediments in the		PLANT WATER POTENTIAL
Netherlands,	PIPELINES Seismic Design Criteria for Buried Water Pipe-	Water Balance and Crops in Karnataka, W85-02127 21
W85-02092 2H	line in Puerto Rico,	
Influence of Simulated Groundwater-Movement	W85-01821 8A	PLANT WATER STATUS
on the Phosphorus Release from Sediments, as Measured in a Continuous Flow System,	Corrosion and Protection of Pipes in Develop-	Developing the Resource Potential of a Shallow Water Table.
W85-02094 2F	ing Countries, W85-01991 8A	W85-01832 3B
PHOSPHORUS REMOVAL		PLUMBING
Pilot Plant Demonstration of Biological Phos-	Corrosion Behaviour of Cast Iron Pipes, W85-01994 8G	Control of Metal Contaminants in Drinking
phorus Removal,		Water in Denmark,
W85-01657 5D	New Materials in Pipe Networks - Special Con-	W85-01993 5F
PHOTOCATALYSIS	sideration of Internal Coatings, W85-01997 2G	PLUVIOGRAPHS
Investigation of Photocatalytic Oxidation for		Overflow Data of Rainwater Discharge Systems
Wastewater Cleanup and Reuse, W85-01813 5D	Planning, Implementation of Directives and Pipelaying Standards,	Determined From Run Off Simulation of Plu- viograph Records.
	W85-01998 6B	W85-01698 2E
PHOTOMETRY Determination of Chlorine Dioxide and Chlorite	Comparison of Water Mains Cleaning Tech-	POLICY
in Drinking-Water (Bestimmung von Chlor-	niques - The Experiment of Begles (Comparai-	Use of Models for Water Resources Manage-
dioxid und Chlorit im Trinkwasser),	son des Techniques de Curage des Conduites	ment, Planning, and Policy,
W85-01664 5F	d'Eau Potable - L'Experience de Begles), W85-01999 8A	W85-02146 6A
PHYSICOCHEMICAL CHARACTERISTICS	PIPES	POLLUTANT IDENTIFICATION
Change in Quality of Thermal Groundwater From a Unique Resource in Lebanon,	Corrosion and Protection of Pipes in Develop-	Preliminary Findings of the Priority Pollutant
W85-01673 2F	ing Countries,	Monitoring Project of the Nationwide Urban
PHYSICOCHEMICAL PROPERTIES	W85-01991 8A	Runoff Program, W85-01661 5A
Influence of Physico-Chemical Factors on the	Usefulness of Measuring the Corrosion Rates of	
Coliform Bacteria in a Closed-Lake Water	Soils (Utilite des Mesures de Corrosivitie des Sols),	Determination of 4-Aminophenol in Water by High-Performance Liquid Chromatography
System, W85-01672 2H	W85-01992 8G	with Fluorescence Detection,
	PLANKTON	W85-01746 5A
Physical and Geochemical Characteristics of Suspended Solids, Wilton Creek, Ontario,	Trophic Ecology of Fish Rearing Ponds,	Pesticide and PCB Levels in Fish from Alberta
W85-02056 2H	W85-01833 2H	(Canada).
PHYTOLITHS	PLANNING	W85-01954 5A
Erosion and Sedimentation Chronology of	New Ecological Approach to the Water Cycle:	Identification of Nonionic Detergents by GC/
Three Watersheds in Maryland,	Ticket to the Future, W85-01704 6A	CI-MS: I. A Complementary Method or an At-
W85-01835 2J		tractive Alternative to GC/EI-MS and Other Methods,
PHYTOPLANKTON	Rationalization of Central Planning in Water Management Through the Introduction of EDP	W85-01955 5A
Influence of the St. Marys River Plume on Northern Lake Huron Phytoplankton Assem-	(Rationalizierung der zentralen Planung in der	Method for Total Organic Chlorine Determina-
blages,	Wasserwirtschaft durch Einsatz der EDV),	tion in Bleach Plant Recipient Waters,
W85-01756 2H	W85-01879 7C	W85-01962 5A
Terrestrial Runoff as a Cause of Outbreaks of	Computer Modeling in Water System Planning	Some Observations on the Chemical Composi-
Acanthaster planci (Echinodermata: Asteroi-	and Design, W85-01906 5F	tion of Precipitation in an Industrial Area and
dea), W85-01893 5C		It's Use in Air Quality Assessment,
	Economising Water and Fighting against Wast- age (Economie d'Eau et Lutte contre le Gaspil-	W85-02129 5B
Phytoplankton Population Dynamics of a Small Reservoir: Effect of Intermittent Mixing on Phy-	lage),	POLLUTION LOAD
toplankton Succession and the Growth of Blue-	W85-01996 6B	Integrated Methodology for Instream Flow
green Algae,	Planning, Implementation of Directives and	Strategies, W85-01951 5B
W85-01916 2H	Pipelaying Standards, W85-01998 6B	
Longterm Effects of the Herbicides Atrazine		POLYCHAETES Environmental and Biochemical Investigation of
and Dichlobenil upon the Phytoplankton Densi- ty and Physico-chemical Conditions in Compart-	Irrigated Agricultural Expansion Planning in Developing Countries: Investment Scheduling	Some Effects of Organic Pollution in Inner Os-
ments of a Freshwater Pond,	Incorporating Drainage Water Reuse,	lofjord, Norway,
W85-01967 5C	W85-02142 3F	W85-01896 5C
PHYTOTOXICITY	Irrigated Agricultural Expansion Planning in	POLYCHLORINATED BIPHENYLS
Toxicity of Chlorine to a Common Vascular	Developing Countries: Income Redistribution	Net Atmospheric Inputs of PCBs to the Ice
Aquatic Plant, W85-01731 5C	Objective, W85-02143 3F	Cover on Lake Huron, W85-01759 5B

POLYCHLORINATED BIPHENYLS

River Elbe: Processes Affecting the Behaviour of Metals and Organochlorines During Estuarine	POTENTIOMETRIC LEVEL Regional Geohydrology of the Northern Louisi-	Case for Automated Water Management, W85-02130 6A
Mixing,	ana Salt-Dome Basin, Part III, Potentiometric	
W85-01836 5B	Levels of the Wilcox-Carrizo and Sparta	PUMPS Pumps for Liquids, Especially for Wastewater
Hepatic Mixed-Function Oxidases in California	Aquifers, W85-01785 2F	(Pumpen fur Flussigkeiten, insbesondere fur Abwasser).
Flatfishes are Increased in Contaminated Envi- ronments and by Oil and PCB Ingestion,	Three-Dimensional Digital-Computer Model of	W85-01864 8C
W85-01894 5A	the Principal Ground-Water Reservoir of the Sevier Desert, Utah,	QUALITY ASSURANCE
Pesticide and PCB Levels in Fish from Alberta (Canada).	W85-01925 7C	Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geolog-
W85-01954 5A	Water-Level Maps of the Alluvial Aquifer in Northwestern Mississippi, April 1983,	ical Survey for Water-Year 1982, W85-01768 7C
POLYCYCLIC AROMATIC HYDROCARBONS	W85-01944 7C	
Behaviour of Polycyclic Aromatic Hydrocar- bons in the Exe Estuary, Devon,	POTOMAC RIVER	RADIOACTIVE DECAY Contaminant Transport in Fractured Porous
W85-01841 5B	Kepone Concentration in Juvenile Anadromous	Media: Analytical Solution for a Two-Member
Urban Runoff as a Source of Polycyclic Aro-	Fishes, W85-01847 5B	Decay Chain in a Single Fracture, W85-02170 5B
matic Hydrocarbons to Coastal Waters,	Benthic Phosphorus Regeneration in the Poto-	
W85-02108 5B	mac River Estuary,	RADIOACTIVE WASTES Model for Instream Regulation of Radioisotopes
POOLS	W85-02088 2L	and Heavy Metals in Riverine Waters Subjected
Objective Identification of Pools and Riffles, W85-02159 2E	POWDER RIVER BASIN	to a Uranium Mill Discharge, W85-02068 5B
	Potential Effects of Surface Coal Mining on the Hydrology of the Corral Creek Area, Hanging	
POPLAR Stomatal Control of Water Use Efficiency in	Woman Creek Coal Field, Southeastern Mon-	RADIOISOTOPES Model for Instream Regulation of Radioisotopes
Poplar Clones and Hybrids,	tann, W85-02040 5B	and Heavy Metals in Riverine Waters Subjected
W85-01646 2I		to a Uranium Mill Discharge, W85-02068 5B
POPULATION DYNAMICS	POWERPLANTS Analysis of Aqueous Sediments for Heavy	
Phytoplankton Population Dynamics of a Small Reservoir: Effect of Intermittent Mixing on Phy-	Metals,	RADIONUCLIDES Distribution and Concentrations of Naturally-
toplankton Succession and the Growth of Blue-	W85-01742 5B	Occurring Radionuclides in Sediments in a Ura-
green Algae,	PRECIPITATION SCAVENGING	nium Mining Area of Northern Saskatchewan, Canada,
W85-01916 2H	Some Observations on the Chemical Composi- tion of Precipitation in an Industrial Area and	W85-02083 5B
POROSITY Double-Porosity Models for a Fissured Ground-	It's Use in Air Quality Assessment,	RADIUM RADIOISOTOPES
water Reservoir with Fracture Skin,	W85-02129 5B	226Ra and 228Ra in the Mixing Zones of the Pee
W85-02150 2F	PRESSURE TRANSIENT ANALYSIS Pressure Transient Analysis for Two-Phase	Dee River-Winyah Bay, Yangtze River and Delaware Bay Estuaries,
POROUS MEDIA	Geothermal Wells: Some Numerical Results,	W85-01912 2L
Motion of Two Compressible Fluids with Inter- face in a Porous Reservoir,	W85-02163 2F	RAINFALL
W85-02154 2F	PRETREATMENT	Review of Rainfall Data Application for Design
Contaminant Transport in Fractured Porous	Evalution of Hollow Fiber Ultrafiltration as a Pretreatment for Reverse Osmosis Desalination	and Analysis, W85-01677 2B
Media: Analytical Solution for a Two-Member	of Seawater,	
Decay Chain in a Single Fracture, W85-02170 5B	W85-01830 3A	Rainfall Events as Paths of a Stochastic Process: Problems of Design Storm Analysis,
	PRIMA FACIE	W85-01684 2B
PORT OF SPAIN Design Storm for a Tropical Location with Lim-	Tort Recovery of Acid Rain Damages in the United States - Observations on Plaintiff's Prima	Univariate Versus Multivariate Rainfall Statis-
ited Data,	Facie Case,	tics - Problems and Potentials,
W85-01678 2B	W85-01667 6E	W85-01685 2B
PORT PHILLIP BAY	PRODUCTIVITY	Time Patterns of Rainfall For Estimating Design Floods on a Frequency Basis,
Aromatic Hydrocarbons in Waters of Port Phil- lip Bay and the Yarra River Estuary,	Limnology in Reservoirs on the Colorado River, W85-01812 2H	W85-01687 2B
W85-01644 5B	PROJECTION	Stochastic Description of Temporal Daily Rain-
POTABLE WATER	Projected Public Supply and Rural (Self-Sup-	fall Patterns,
Microbial Contamination of Potable Water in	plied) Water Use in Florida Through Year 2020, W85-02036 7C	W85-01712 2B
Distribution Systems, W85-01796 5F		Case Study of Heavy Rain Spell on 13th-25th
	PROTECTION Corrosion and Protection of Pipes in Develop-	December 1982 over the East Coast of Peninsu- lar Malaysia and Singapore,
Water Supply of Alexandria Egypt, W85-01985 5F	ing Countries,	W85-02125 2B
	W85-01991 8A	RAINFALL DISTRIBUTION
Distribution of Nitrates in the Potable Waters of Sri Lanka,	PUBLIC WATER SUPPLY	Synthetic Design Storm and its Relation to In-
W85-02015 5B	Projected Public Supply and Rural (Self-Sup- plied) Water Use in Florida Through Year 2020,	tensity-Duration Frequency Curves, W85-01679 2B
Effect of Noncoliforms on Coliform Detection	W85-02036 7C	Statistical Methods of Storm Analysis,
in Potable Groundwater: Improved Recovery	PUERTO RICO	W85-01680 2B
with an Anaerobic Membrane Filter Technique, W85-02140 5F	Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico,	Some Statistical Properties of Short-Duration
POTENTIOMETRIC FLOW	W85-01963 5E	Rainfall,
Trends and Fluctuations in the Potentiometric	PUMPING PLANTS	W85-01681 2B
Surface of the Floridan Aquifer, West-Central Florida, 1961-80,	Pump Station Design: The Benefits of Computer	Rainfall as the Basis for Urban Runoff - Experi-
W85-01940 7C	Modeling, W85-01905 8C	ence and Practice in Yugoslavia, W85-01682 2B

Stochastic Characterization of Temporal Storm Patterns, W85-01686 2B	Improvement of Flood-Frequency Estimates for Selected Small Watersheds in Eastern Kansas using a Rainfall-Runoff Model,	RED TIDE Behavior of Organically-Bound Iron in Seawater
	W85-01786 2A	of Estuaries, W85-01913 2L
Time Patterns of Rainfall For Estimating Design Floods on a Frequency Basis,	Land Use, Runoff and Recharge on Selected	
W85-01687 2B	Watersheds in the U.S. Virgin Islands, W85-01799 4C	REGIONAL FLOODS Flood Potential of Fortymile Wash and its Prin-
Temporal Distribution of Design Storm Rainfall, W85-01688 2B	Flood-Frequency Estimates for Five Gaged	cipal Southwestern Tributaries, Nevada Test Site, Southern Nevada, W85-02037 2E
Effect of Spatial Rainfall Distribution on Sewer	Basins in Wichita, Kansas, W85-01949 2A	
Flows, W85-01689 2E	RAINSTORMS	REGRESSION ANALYSIS Estimates of Dissolved and Suspended Sub-
Norwegian Activities on Collection and Re-	Statistical Methods of Storm Analysis,	stance Yield of Stream Basins in Michigan, W85-01942 5A
search on Rainfall Data, W85-01691 2B	W85-01680 2B Some Statistical Properties of Short-Duration	W85-01942 5A REGULATIONS
	Rainfall,	Major Institutional Arrangements Affecting
Staged Approach to Application of Rainfall Data to Urban Runoff Calculations,	W85-01681 2B	Ground Water in New York State, W85-01802 6E
W85-01694 2E	Stochastic Characterization of Temporal Storm Patterns,	REMOTE CONTROL
Rainfall Data For the Design of Detention Basins,	W85-01686 2B	Practical Introduction of the Remote Control Systems and Process Control Facilities,
W85-01695 2E	RAKAIA RIVER Critical Depths for Passage in Braided Rivers,	W85-02006 6A
Real-Time Estimation and Forecasting of Spa-	Canterbury, New Zealand,	REMOTE SENSING
tially Distributed Areal Rainfall, W85-01700 2B	W85-01636 2E	Application of Remote-Sensing Techniques to
Potential Urban Rainfall Prediction Measure-	RAMAN SPECTROSCOPY Determination of Phenols in Water Using	Hydrologic Studies in Selected Coal-Mined Areas of Southeastern Kansas,
ment System,	Raman Spectroscopy,	W85-01947 5B
W85-01701 2B	W85-02114 5A	Microwave Measurements of Moisture Distribu-
RAINFALL ENERGY Rainfall Energy From Drop Size Data,	RAPID CITY Flood-plain Management Program in Rapid	tions in the Upper Soil Profile, W85-02160 2G
W85-01696 2B	City, South Dakota,	
RAINFALL IMPACT	W85-01643 2E	RESEARCH PRIORITIES Status of Research and Development in Water
Influence of Rainfall Characteristics on the Pol-	RAPID INFILTRATION Fate of Trace Organics During Rapid Infiltra-	Supply Systems in India,
lution Emission, W85-01697 2E	tion of Primary Wastewater at Fort Devens,	W85-01982 3D
RAINFALL INTENSITY	Massachusetts, W85-01730 5D	RESERVED WATER Report on Hydroelectric Power Utilization and
Norwegian Activities on Collection and Re-	RAPPAHANNOCK RIVER	Reserved-Water Problems (Bericht uber Was-
search on Rainfall Data, W85-01691 2B	Annual Cycle of Kepone Residue and Lipid	serkraftuntzung und Restwasserprobleme). W85-01855 4A
Additional Tests on the Effect of Rainfall Inten-	Content of the Estuarine Clam, Rangia cuneata, W85-01844 5C	RESERVOIR OPERATION
sity on Storm Flow and Peak Flow from Wild- Land Basins,	Kepone Concentration in Juvenile Anadromous	Tasks of the Dam Keeper (Les Taches du Gar-
W85-02166 2E	Fishes, W85-01847 5B	dien de Barrage), W85-01859 4A
RAINFALL-RUNOFF		
Magnitude and Frequency of Floods from	RAYLEIGH SCATTERING Transport Phenomena New Experimental Re-	Descriptive Decision Process Model for Hierar- chical Management of Interconnected Reservoir
Urban Streams in Leon County, Florida, W85-02047 4A	sults in Hydrodynamical 'Forced Rayleigh Scat-	Systems,
RAINFALL-RUNOFF RELATIONSHIPS	tering' (Phenomenes de Transport Nouveaux resultats experimentaux en diffusion 'Rayleigh	W85-02147 4A
Review of Rainfall Data Application for Design	forcee' hydrodynamic),	RESERVOIRS Some Ecological Consequences of a Projected
and Analysis, W85-01677 2B	W85-01745	Deep Reservoir in the Kabalebo River in Surin-
Rainfall as the Basis for Urban Runoff - Experi-	REACTION KINETICS Investigation of Photocatalytic Oxidation for	ame, W85-01764 6G
ence and Practice in Yugoslavia, W85-01682 2B	Wastewater Cleanup and Reuse, W85-01813 5D	RESIDUAL CHLORINE
	most and the second	Evaluation of Electrode Methods for Determin-
Depth-Duration Models of Short Time Increment Rainfall,	REAL TIME Real Time Irrigation Scheduling via 'Reaching'	ing Total Residual Chlorine in Various Water Matrices,
W85-01683 2B	Dynamic Programming, W85-02155 3F	W85-02123 7B
Effect of Spatial Rainfall Distribution on Sewer	RECLAIMED WATER	RESTAURANTS
Flows, W85-01689 2E	Geohydrology of the Meadowbrook Artificial-	Analysis of Quantitative Wastewater Measure- ments of a Country Restaurant Situated at Ap-
Areal Reduction Factors on Short Time and	Recharge Project Site in East Meadow, Nassau County, New York.	proximately 1080 m Altitude and of a Mountain
Space Intervals, W85-01690 2B	W85-01774 2F	Inn Situated at Approximately 1410 m Altitude (Auswertung von Schmutzwasser-Mengenmes-
	RECLAMATION	sungen bei einem Ausflugsrestaurant, rund 1080
Overflow Data of Rainwater Discharge Systems Determined From Run Off Simulation of Plu-	Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined	m u. M. und bei einem Berggasthof, rund 1410 m u. M.),
viograph Records,	Areas of Southeastern Kansas,	W85-01854 5D
W85-01698 2E	W85-01947 5B	REVEGETATION
Methods For Calculation of Annual and Ex- treme Overflow Events From Combined Sewer	RED CHALK LAKE Historical Changes in Anthropogenic Lead Fall-	Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined
Systems,	out in Southern Ontario, Canada,	Areas of Southeastern Kansas,
W85-01699 2E	W85-02063 5B	W85-01947 5B

REVERSE OSMOSIS

REVERSE OSMOSIS	ROCKFILL DAMS	SALINITY
Status of Reverse Osmosis vs. Ion Exchange for	Progress in Rockfill Dams,	Behavior of Organically-Bound Iron in Seawater
Petroleum/Petrochemical Utilities, W85-01853 5F	W85-01870 8A	of Estuaries, W85-01913 2L
Biological Fouling of Reverse Osmosis Mem-	ROSTOCK	SALMON
branes,	Construction of Rationalization Equipment at the Rostock Water-Supply and Wastewater-	Logging Impacts and Some Mechanisms that
W85-01977 5D	treatment Facility (Rationalisierungsmittelbau	Determine the Size of Spring and Summer Populations of Coho Salmon Fry (Oncorhynchus
REVIEWS	im VEB Wasserversorgung und Abwasserbe- handlung Rostock),	kisutch) in Carnation Creek, British Columbia,
Progress in Rockfill Dams, W85-01870 8A	W85-01877 5F	W85-01919 5C
	ROTORUA	SALMON CREEK
RHINE RIVER Geochemistry of the Rhine and the Rhone and	Water Quality of the Waiohewa Stream, Ro-	Partitioning of Phosphorus Between Particles and Water in a River Outflow,
Human Impact (La Geochimie du Rhin et du Rhone et L'impact Humain),	torua, W85-01634 5B	W85-02075 2H
W85-02059 2H	Nitrogen and Phosphorus in the Ngongotaha	SALT MARSHES Relative Contributions of Bacteria and Fungi to
RHODE ISLAND Water Resources Data, Massachusetts and	Stream, W85-01635 5B	Rates of Degradation of Lignocellulosic Detri-
Rhode Island, Water Year 1982, W85-01935 2E	ROTTNEST ISLAND	tus in Salt-Marsh Sediments, W85-02138 2L
W83-01933	Seasonal Meromixis in Three Hypersaline Lakes	CAMPATRIC
Aquifer Tests in the Stratified Drift, Chipuxet River Basin, Rhode Island,	on Rottnest Island, Western Australia, W85-01645 2H	SAMPLING Traveling Screens as Sampling Gear for Vertical
W85-02039 2F		Distribution Studies, W85-01842 7B
RHONE RIVER	RUAHINE RANGE	
Geochemistry of the Rhine and the Rhone and	Drought Effect on High-Altitude Forests, Rua- hine Range, North Island, New Zealand,	SAN DIEGO COUNTY
Human Impact (La Geochimie du Rhin et du Rhone et L'impact Humain),	W85-01886 2A	Man-Made Structures on Marine Sediments: Ef- fects on Adjacent Benthic Communities,
W85-02059 2H	RUNGIS	W85-01895 6G
	Areal Reduction Factors on Short Time and	SAND
RICE	Space Intervals,	Earth Foundation Treatment at Jebba Dam Site,
Decomposition of Wild Rice (Zizania aquatica) Straw in Two Natural Lakes of Northwestern	W85-01690 2B	W85-01871 8D
Ontario, W85-01647 2H	RUNOFF	SAND AQUIFERS
W83-01047	Behaviour of Polycyclic Aromatic Hydrocar-	Shallow Ground-Water Flow and Drainage
RIFFLES	bons in the Exe Estuary, Devon, W85-01841 5B	Characteristics of the Brown Ditch Basin near the East Unit, Indiana Dunes National Lake-
Objective Identification of Pools and Riffles, W85-02159 2E	W45-01041	shore, Indiana, 1982,
	Runoff from Utility Waste Landfill to be Recy-	W85-01948 4A
RISKS	cled from Detention Basin to Scrubber Make- Up,	SANITATION
Comparison of the Carcinogenic Risks from Fish vs. Groundwater Contamination by Organic	W85-01849 5D	Water Decade (La Decennie de l'Eau),
Compounds,	Terrestrial Runoff as a Cause of Outbreaks of	W85-01984 6B
W85-02110 5C	Acanthaster planci (Echinodermata: Asteroi-	SANTA ANA RIVER
RIVER BASINS	dea),	Santa Ana River: An Example of a Sandy Braid-
Estimates of Dissolved and Suspended Sub-	W85-01893 5C	ed Floodplain System Showing Sediment Source Area Imprintation and Selective Sediment Modi-
stance Yield of Stream Basins in Michigan, W85-01942 5A	RUNOFF SIMULATION	fication,
***	Overflow Data of Rainwater Discharge Systems	W85-01735 2J
RIVER GREAT STOUR	Determined From Run Off Simulation of Plu-	SARONIKOS GULF
Growth of Cladophora glomerata in a River Receiving Sewage Effluent,	viograph Records, W85-01698 2E	Mytilus galloprovincialis and Parapenaeus lon-
W85-01723 5C	W85-01698 2E	girostris as Bioindicators of Heavy Metal and
RIVER MORPHOLOGY	RURAL AREAS	Organochlorine Pollution,
Morphology and Recent Sediments of the	Feasibility Study of Developing Valley-Fill	W85-01899 5A
Lower Anastomosing Reaches of the Attawapis-	Aquifers for Village Water Supplies in Southern Guam.	SASKATCHEWAN
kat River, James Bay, Ontario, Canada,	W85-02026 2F	Model for Instream Regulation of Radioisotopes
W85-01734 2J		and Heavy Metals in Riverine Waters Subjected to a Uranium Mill Discharge,
RIVER WESER	SAFETY Evaluation of the Visibility Criterion of the Mas-	W85-02068 5B
River Weser Processes Affecting the Behaviour	sachusetts Sanitary Code for Swimming in Natu-	
of Metals and Organochlorines during Estuarine	ral Waters,	Distribution and Concentrations of Naturally-
Mixing, W85-01837 5B	W85-01800 6E	Occurring Radionuclides in Sediments in a Ura- nium Mining Area of Northern Saskatchewan,
RIVERS	SALINE LAKES	Canada,
Removal of Volatile Organic Pollutants from	Seasonal Meromixis in Three Hypersaline Lakes	W85-02083 5B
Rapid Streams, W85-01738 5B	on Rottnest Island, Western Australia, W85-01645 2H	SATELLITE TECHNOLOGY Satellite-Tracked Current Drifters in Lake
	SALINE WATER	Michigan,
Wastewater Purification as Related to the Study of a River System (Abwasserreiningung in Ver-	Origins and Distribution of Saline Ground	W85-01760 7B
bindung mit der Untersuchung eines Flusssys-	Waters in the Floridan Aquifer in Coastal South-	SEASONAL VARIATION
tems),	west Florida,	Tidal and Seasonal Variations of Sulfate Ion in a
W85-01885 5D	W85-01778 2K	New Jersey Marsh System,
Study of Habitat Conditions of the Macrophytic	SALINE WATER INTRUSION	W85-01848 5B

5B

SEDIMENT ANALYSIS
Standardization of Methods of Analysis for Heavy Metals in Sediments,
W85-02104 5A

Study of Habitat Conditions of the Macrophytic Vegetation in Selected River Systems in Western Lower Saxony (Federal Republic of Germany),
W85-01887

SALINE WATER INTRUSION
Occurrence, Quality, and Use of Ground Water in Oreas, San Juan, Lopez, and Shaw Islands, San Juan County, Washington,
W85-02043

7C

SEDIMENT BUDGET Sediment Transport in the Lower Yampa River, Northwestern Colorado,	Improved Operational Control of Sedimentation Facilities Through the Use of Fiberoptic Sensors (Verbesserte Betriebskontrolle von Sedimenta-	Hydrocarbon Accumulation in Freshwater Sediments of an Urban Catchment, W85-02078 5B
W85-02045 2J	tionsanlagen durch Nutzung faseroptischer Sen-	The state of the s
SEDIMENT DISCHARGE Sediment Transport in the Tanana River near	soren), W85-01882 5D	Particle Size Distribution and Chemical Param- eters of the Sediments of a Shallow Turbid Im- poundment,
Fairbanks, Alaska, 1982, W85-01769 2J	Sedimentation Success from Modified Jar Tests, W85-01910 5F	W85-02082 2H
SEDIMENT DISCHARGES Daily Water and Sediment Discharges from Selected Rivers of the Eastern United States: A	Entrainment, Deposition, and Transport of Fine- Grained Sediments in Lakes, W85-02055 2J	Distribution and Concentrations of Naturally- Occurring Radionuclides in Sediments in a Ura- nium Mining Area of Northern Saskatchewan, Canada.
Time-Series Modeling Approach, W85-01823 2J	Sedimentation in Fluvial and Lacustrine Envi-	W85-02083 5B
SEDIMENT EROSION Comparison of Sediment Energy-Texture Rela-	W85-02057 2J	Vertical Stratification in Sediments from a Young Oligotrophic South African Impound- ment: Implications in Phosphorus Cycling,
tionships in Marine and Lacustrine Environ- ments,	Basic Concepts and Associated Statistical Meth- odology in the Geochemical Study of Lake Sediments,	W85-02086 2H
W85-02058 2J	W85-02064 2J	Transport of Iron and Manganese in Relation to the Shapes of Their Concentration-Depth Pro-
SEDIMENT LOAD Sediment Transport in the Tanana River near Fairbanks, Alaska, 1982,	Sedimentation Rates in a Swiss-Italian Lake Measured with Sediment Traps,	files, W85-02090 2K
W85-01769 2J	W85-02100 2J	Influence of Simulated Groundwater-Movement
Statistical Analysis and Evaluation of Water- Quality Data for Selected Streams in the Coal Area of East-Central Montana,	Effects of Sedimentation on the Storage Capacity of the High Aswan Dam Reservoir, W85-02101 4A	on the Phosphorus Release from Sediments, as Measured in a Continuous Flow System, W85-02094 2F
W85-01770 5B Sediment Transport in the Tanana River near	Climatic and Anthropogenic Effects on the Sedi- mentation and Geochemistry of Lakes Bourget,	SEISMIC PROPERTIES Seismic Design Criteria for Buried Water Pipe-
Fairbanks, Alaska, 1980-81, W85-01788 2J	Annecy and Leman, W85-02102 2H	line in Puerto Rico, W85-01821 8A
SEDIMENT OXYGEN DEMAND	Sediment Concentrations from Intensively Pre-	
Flux of Reduced Chemical Constituents (Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-	pared Wetland Sites, W85-02112 4C	SELENASTRUM Response of Algal Populations to Changes in Stream Water Quality,
ment Oxygen Demand in Lake Erie, W85-02087 2H	SEDIMENTS	W85-01797 5C
SEDIMENT TRANSPORT Sediment Transport in the Tanana River near Fairbanks, Alaska, 1980-81,	Morphology and Recent Sediments of the Lower Anastomosing Reaches of the Attawapis- kat River, James Bay, Ontario, Canada, W85-01734 2J	SENSORS Improved Operational Control of Sedimentation Facilities Through the Use of Fiberoptic Sensors
W85-01788 2J Sediment Transport in the Lower Yampa River,	Santa Ana River: An Example of a Sandy Braided Floodplain System Showing Sediment Source	(Verbesserte Betriebskontrolle von Sedimenta- tionsanlagen durch Nutzung faseroptischer Sen- soren),
Northwestern Colorado, W85-02045 2J	Area Imprintation and Selective Sediment Modification,	W85-01882 5D SESTON
SEDIMENT-WATER INTERFACE	W85-01735 2J	Phosphate Adsorption Kinetics of Resuspended
Carbon Flow Across the Sediment-Water Inter- face in Lake Vechten, The Netherlands,	Release of Sediment-Phosphorus and the Influence of Algal Growth on This Process,	Sediments in a Shallow Lake, Neusiedlersee, Austria,
W85-02066 2H	W85-01761 2H	W85-02079 2H
Diurnal Variation in the Oxygen Uptake of River Sediments in Vitro by Use of Continuous Flow-Through Systems, W85-02069 2E	Accumulation of the Trace Elements Lead and Zinc by Asellus communis at Three Different pH Levels, W85-01795 5B	Runoff from Utility Waste Landfill to be Recy- cled from Detention Basin to Scrubber Make- Up,
Rates of Sediment-Water Exchange of Oxygen	Chemical Study of the Interstitial Water Dis-	W85-01849 5D
and Sediment Bioturbation in Lough Neagh, Northern Ireland, W85-02085 2H	solved Organic Matter and Gases in Lake Erie, Cleveland Harbor, and Hamilton Harbour Bottom Sediments—Composition and Fluxes to	SEWAGE BACTERIA Microorganism Survival in an Ice-Covered
Benthic Phosphorus Regeneration in the Poto-	Overlying Waters, W85-01814 5B	River, W85-01708 5B
mac River Estuary, W85-02088 2L	Behaviour of Polycyclic Aromatic Hydrocar-	SEWER HYDRAULICS Effect of Spatial Rainfall Distribution on Sewer
SEDIMENT-WATER INTERFACES Mass Balance Models of Phosphorus in Sedi-	bons in the Exe Estuary, Devon, W85-01841 5B	Flows, W85-01689 2E
ments and Water, W85-02071 2J	Phosphorus Distribution in Sediments of the Delaware River Estuary,	Design Inflow Intensity and Design Inflow Pro-
SEDIMENT YIELD	W85-01843 2L	files For Storm Sewers, W85-01692 2E
Land Use Effects on Sediment Yield and Qual- ity,	Hydrocarbons in Washington Coastal Sedi- ments,	SHALLOW WATER
W85-02060 6G	W85-01915 5B	Wind Induced Diffusion in a Shallow Lake, A Case Study,
SEDIMENTATION Sedimentation of Organic and Inorganic Particu-	Comparison of Sediment Energy-Texture Rela- tionships in Marine and Lacustrine Environ-	W85-01763 2H
late Material in Lindaspollene, a Stratified, Land-Locked Fjord in Western Norway,	ments, W85-02058 2J	Developing the Resource Potential of a Shallow Water Table,
W85-01767 2L	Experimental Measurement of Sediment Nitrifi-	W85-01832 3B
Erosion and Sedimentation Chronology of Three Watersheds in Maryland,		Loading Concentration Models for Phosphate in Shallow Lakes,
W85-01835 2J	W85-02070 2H	W85-02067 2H

SHALLOW WATER

Phosphate Adsorption Kinetics of Resuspended	SODIUM CARBONATE	Travel Times from Buried and Surface Infiltra- tion Point Sources.
Sediments in a Shallow Lake, Neusiedlersee, Austria,	Acidified Lakes: Sediment Treatment with Sodium Carbonate - A Remedy,	W85-02167 2G
W85-02079 2H	W85-02096 5G	4 63-02107
All the second s		Effect of Clear-Cut Silviculture on Dissolved
SHEETPILE INTERLOCK TENSION	SODIUM CHLORITE Lack of Nephrotoxicity in the Rat by Sodium	Ion Export and Water Yield in the Piedmont,
Sheetpile Interlock Tension in Cellular Coffer- dams.	Chlorite, a Possible Byproduct of Chlorine Di-	W85-02171 5B
W85-01872 8A	oxide Disinfection in Drinking Water,	SOLUTIONS
	W85-02119 5F	Toxicity of Organic Mixtures Saturated in Water
SHRIMP	SOFT WATER	to Daphnia magna. Effect of Compositional
Mytilus galloprovincialis and Parapenaeus Ion- girostris as Bioindicators of Heavy Metal and	Impact of Acidification and Eutrophication on	Changes,
Organochlorine Pollution,	Macrophyte Communites in Soft Waters. II. Ex-	W85-01953 5C
W85-01899 5A	perimental Studies,	SORPTION
SIMULATED RAINFALL	W85-01889 5C	Use of Fixed-Bed Adsorber Models to Predict
Temporal Distribution of Design Storm Rainfall,	SOIL	the Fluxes of Toxic Substances in Groundwaters
W85-01688 2B	Use of Fixed-Bed Adsorber Models to Predict	and Soil Environments,
	the Fluxes of Toxic Substances in Groundwaters	W85-01793 5B
SIMULATION ANALYSIS LP Embedded Simulation Model for Conjunc-	and Soil Environments, W85-01793 5B	SOUTH AFRICA
tive Use Management Optimization,	W63-01793	Particle Size Distribution and Chemical Param-
W85-01801 4B	SOIL EROSION	eters of the Sediments of a Shallow Turbid Im-
	Erosion and Sedimentation Chronology of	poundment,
SINGAPORE Case Study of Heavy Rain Spell on 13th-25th	Three Watersheds in Maryland, W85-01835 2J	W85-02082 2H
December 1982 over the East Coast of Peninsu-	W83-01833	Vertical Stratification in Sediments from a
lar Malaysia and Singapore,	SOIL PROPERTIES	Young Oligotrophic South African Impound-
W85-02125 2B	Heavy Metal Migration in Soil-Leachate Sys-	ment: Implications in Phosphorus Cycling,
SKEWNESS	tems, W85-01868 5B	W85-02086 2H
Estimation of Skewness of Hydrologic Varia-	W 63-01606	Organization and Fundantian of Interlahamters
bles,	SOIL SALINITY	Organization and Evaluation of Interlaboratory Comparison Studies among Southern African
W85-02161 2A	Developing the Resource Potential of a Shallow	Water Analysis Laboratories,
OF AND BUTTON	Water Table, W85-01832 3B	W85-02117 5A
SLAVE RIVER Microorganism Survival in an Ice-Covered	W63-01632 3B	
River,	SOIL TYPES	SOUTH CAROLINA
W85-01708 5B	Soils of Swamps in the Apalachicola, Florida,	Drought in Southeastern United States,
OF ORE AREA SELECTION AND ADDRESS.	Estuary, W85-01641 2L	W85-01642 2B
SLOPE-AREA MEASUREMENT Annual Water-Resources Review, White Sands	W 63-01041	Transport of Dissolved Organic Carbon through
Missile Range, New Mexico, 1982,	SOIL WATER	a Major Creek of the North Inlet Ecosystem,
W85-01927 2E	Microwave Measurements of Moisture Distribu-	W85-01766 2L
CHINCE	tions in the Upper Soil Profile, W85-02160 2G	Computer-Assisted Water System Analysis and
SLUDGE Conventional Water Process Costs Studied,	W 63-02100 2G	Design for Charleston, S.C.,
W85-01706 5D	SOLAR RADIATION	W85-01907 5F
	Vertical Temperature Distribution in Lakes,	
Metals Distributions in Activated Sludge Sys-	W85-01651 2H	Water Resources Data, South Carolina, Water
tems, W85-01737 5D	SOLEDUCK RIVER	Year 1982, W85-01937 2E
#85-01/3/	Flood Elevations for the Soleduck River at Sol	W 63-01937 2E
SMALL WATERSHEDS	Duc Hot Springs, Clallam County, Washington,	Sediment Concentrations from Intensively Pre-
Improvement of Flood-Frequency Estimates for	W85-01773 4A	pared Wetland Sites,
Selected Small Watersheds in Eastern Kansas using a Rainfall-Runoff Model,	SOLID WASTE DISPOSAL	W85-02112 4C
W85-01786 2A	Municipal Solid-Waste Disposal and Ground-	SOUTH DAKOTA
	Water Quality in a Coastal Environment, West-	Flood-plain Management Program in Rapid
Erosion and Sedimentation Chronology of	Central Florida, W85-01789 5E	City, South Dakota,
Three Watersheds in Maryland, W85-01835 2J	#45-01769 JE	W85-01643 2E
	Hydrogeology and Water Quality of Six Landfill	Major Aquifers in Miner County, South Dakota,
SNOWMELT	Sites in Hillsborough County, Florida,	W85-01950 2F
Calculation of Melt-water Discharge from the	W85-01946 5B	W 65-01950
Snow Cover in Catchment Areas in the Mittel- gebirge Mountains (Berechnung der Schmelz-	SOLUBILITY	SPATES
wasserabgabe aus der Schneedecke in Einzugs-	Analysis of Aquatic Toxicity Data: Water Solu-	Influence of Within-Stream Disturbance on Dis-
gebieten des Mittelgebirges),	bility and Acute LC50 Fish Data,	solved Nutrient Levels During Spates,
W85-01972 2C	W85-01966 5C	W85-02089 2E
SOCIAL ASPECTS	Solubility of Organic Mixtures in Water,	SPECIATION
Development and Field Testing of a Methodolo-	W85-02109 5B	Dissolved and Suspended Mercury Species in
gy for Assessing Community Readiness for	SOLUTE TRANSPORT	the Wabigoon River (Ontario, Canada): Seasonal
Self-Help in the Installation, Maintenance and	Use of Fixed-Bed Adsorber Models to Predict	and Regional Variations,
Repair of Water Supply and Sanitation Facili-	the Fluxes of Toxic Substances in Groundwaters	W85-02091 5B
ties,	and Soil Environments,	SPECIFIC YIELD
W85-01980 7C	W85-01793 5B	Aquifer Tests in the Stratified Drift, Chipuxet
Comparision of Water Catchment and Storage	Analysis of Total Phosphorus Transport in	River Basin, Rhode Island,
Systems in Two Micronesian Atoll Communi-	River Systems,	W85-02039 2F
ties: Laura and Nama,	W85-02074 2E	SPECTRAL ANALYSIS
W85-02028 6D	Flux-Averaged and Volume-Averaged Concen-	Daily Water and Sediment Discharges from Se-
SOCIAL COSTS	trations in Continuum Approaches to Solute	lected Rivers of the Eastern United States: A
Cost and Benefits of Drinking Water Treatment,	Transport,	Time-Series Modeling Approach,
W85-01649 5F	W85-02153 2F	W85-01823 2J

SPECTRAL ATTENUATION Spectral Attenuation and Irradiance in the Laurentian Great Lakes, W85-01757 2H	STOCHASTIC PROCESS Rainfall Events as Paths of a Stochastic Process: Problems of Design Storm Analysis, W85-01684 2B	Effects of the Drought of 1980-81 on Stream- flow and on Ground-water Levels in Georgia, W85-01783
SPEED RIVER Mixing Zone Studies in the Grand River Basin,	Stochastic Description of Temporal Daily Rainfall Patterns,	STREAMLINES Three-Dimensional Streamlines in Dupuit-Forchheimer Models,
W85-01710 5B	W85-01712 2B	W85-02148 2F
SPIEZ	STOMATAL TRANSPIRATION	STREAMS
Rebuilding of the Hydro-Electric Power Station of Spiez (Kraftwerk Spiez Erneuerung 1982- 1985),	Stomatal Control of Water Use Efficiency in Poplar Clones and Hybrids, W85-01646 21	Commentary on Environmental Impact Assess- ment for Large Projects Affecting Lakes and
W85-01857 8A	STORAGE COEFFICIENT	Streams, W85-01920 6G
SPORT FISHING	Aquifer Tests in the Stratified Drift, Chipuxet	Availability of Dissolved Oxygen in Interstitial
Evaluation of Fisherman Benefits Stemming from Special Use Fishery Management Pro- grams,	River Basin, Rhode Island, W85-02039 2F	Waters of a Sandy Creek, W85-02103 2E
W85-01831 6B	Various Coating Materials for Potable Water	STRIP MINES
SRI LANKA Geochemistry of Well Water and Cardiovascu-	Concrete Storage Reservoirs - Experiences in Germany, Switzerland and Austria,	Ground-Water Hydrology and Quality before and after Strip Mining of a Small Watershed in
lar Diseases in Sri Lanka,	W85-02000 8G	Jefferson County, Ohio, W85-01943 4C
W85-01674 5C	STORM RUNOFF Rainfall Data For the Design of Detention	Hydrology of an Abandoned Coal-Mining Area
Matara Water Supply Project in Sri Lanka, W85-02013 5F	Basins, W85-01695 2E	near McCurtain, Haskell County, Oklahoma, W85-02041 5B
Distribution of Nitrates in the Potable Waters of	Additional Tests on the Effect of Rainfall Inten-	STRUCTURES
Sri Lanka, W85-02015 5B	sity on Storm Flow and Peak Flow from Wild-	Man-Made Structures on Marine Sediments: Ef-
ST. MARYS RIVER	Land Basins, W85-02166 2E	fects on Adjacent Benthic Communities, W85-01895 6G
Influence of the St. Marys River Plume on	STORM SEWERS	
Northern Lake Huron Phytoplankton Assem- blages,	Design Inflow Intensity and Design Inflow Pro- files For Storm Sewers.	SUBSIDENCE Application of Remote-Sensing Techniques to
W85-01756 2H	W85-01692 2E	Hydrologic Studies in Selected Coal-Mined Areas of Southeastern Kansas,
ST THOMAS	STORM WASTEWATER	W85-01947 5B
Land Use, Runoff and Recharge on Selected Watersheds in the U.S. Virgin Islands, W85-01799 4C	Influence of Rainfall Characteristics on the Pol- lution Emission, W85-01697 2E	SUCCESSION Factors Structuring Fish Assemblages Along a
STABILITY CONSTANTS	Effects of Urbanization on Frequencies of Over-	Bog Lake Successional Gradient, W85-01891 2H
Metal Speciation in Surface Waters of the Great Lakes Region,	flows and Pollutant Loadings from Storm Sewer Overflows: A Derived Distribution Approach,	Phytoplankton Population Dynamics of a Small
W85-01811 5A	W85-02152 5B	Reservoir: Effect of Intermittent Mixing on Phy- toplankton Succession and the Growth of Blue-
STABILIZATION PONDS Effects of Baffles on the Performance of Model	STORM WATER Rainfall Data For the Design of Detention	green Algae, W85-01916 2H
Waste Stabilization Ponds,	Basins, W85-01695 2E	
W85-01719 5D		SUCKERS Bioavailability of Pb and Zn from Mine Tailings
STABLE ISOTOPES Hydrogeochemical Investigation of Thermal Springs in the Black Canyon-Hoover Dam Area,	STORMWATER RUNOFF Effect of Various Hydrologic Parameters on the Quality of Stormwater Runoff from a West La-	as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in
Nevada and Arizona, W85-01804 2K	fayette, Indiana Urban Watershed, W85-01822 5B	Suckers (Pisces: Catostomidae), W85-01918 5.A
	STRATIFIED DRIFT	SUDAN
STANDARDS Evaluation of the Visibility Criterion of the Massachusetts Sanitary Code for Swimming in Natu-	Aquifer Tests in the Stratified Drift, Chipuxet River Basin, Rhode Island,	First Experiences with a Women-Specific Project for the Water Decade,
ral Waters,	W85-02039 2F	W85-02004 5F
W85-01800 6E	STREAM GAGES	SULFATES
STATE WATER LAWS State Laws Mandating Water Conservation,	Computation of Continuous Streamflow Records, W85-02053 2E	Tidal and Seasonal Variations of Sulfate Ion in a New Jersey Marsh System,
W85-01806 6E	STREAM SEDIMENTS	W85-01848 3B
STATISTICAL ANALYSIS Statistical Analysis and Evaluation of Water-	Sedimentation in Fluvial and Lacustrine Envi-	SULFUR BACTERIA Analysis of Pollutant Enhanced Bacterial Blue-
Quality Data for Selected Streams in the Coal Area of East-Central Montana,	ronments, W85-02057 2J	Green Algal Interrelationships Potentiating Sur- face Water Contamination by Noxious Blue-
W85-01770 5B	STREAMBED GRADIENTS Shallow Ground-Water Flow and Drainage	Green Algal Blooms, W85-01803 5C
STATISTICS	Characteristics of the Brown Ditch Basin near	SUMMAQIYEH
Univariate Versus Multivariate Rainfall Statis- tics - Problems and Potentials,	the East Unit, Indiana Dunes National Lake- shore, Indiana, 1982,	Change in Quality of Thermal Groundwater
W85-01685 2B	W85-01948 4A	From a Unique Resource in Lebanon, W85-01673 2F
STEEL INDUSTRY	STREAMFLOW	SURFACE DRAINAGE
Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control,	Hydrologic Responses of Stream's to Mining of the Mulberry Coal Reserves in Eastern Kansas,	Drainage Basins in Duval County, Florida,
W85-01655 5D	W85-01782 2E	W85-02046 70

SURFACE-GROUND WATER RELATIONSHIPS

SURFACE-GROUND WATER RELATIONSHIPS	Heavy Metals in the Lower Mississippi River, W85-01744 5B	Basic Concepts and Associated Statistical Meth- odology in the Geochemical Study of Lake
Hydrology of Lake Padgett, Saxon Lake, and		Sediments,
Adjacent Area, Pasco County, Florida, W85-01826 7C	Uptake of Kepone from Sediment Suspensions and Subsequent Loss by the Oyster Crassostrea	W85-02064 2J
SURFACE RUNOFF	virginia, W85-01897 5B	Manganese Cycle in Lac Leman, Switzerland: The Role of Metallogenium,
Land Use, Runoff and Recharge on Selected	m	W85-02081 2H
Watersheds in the U.S. Virgin Islands, W85-01799 4C	Phosphate Adsorption Kinetics of Resuspended Sediments in a Shallow Lake, Neusiedlersee,	Interaction Between Interstitial Water and Sedi-
SURFACE WATER	Austria, W85-02079 2H	ment in Two Cores of Lac Leman, Switzerland, W85-02084 2H
Reconnaissance of Surface Water Resources in		11 03-02004
the Togiak River Basin, Southwestern Alaska,	Sediment Concentrations from Intensively Pre-	Sedimentation Rates in a Swiss-Italian Lake
1980 and 1982, W85-01777 2A	pared Wetland Sites, W85-02112 4C	Measured with Sediment Traps, W85-02100 2J
	SUSPENDED SOLIDS	Climatic and Anthonorassis Difference the Sadi
Water Resources Data, Iowa, Water Year 1982, W85-01931 2E	Physical and Geochemical Characteristics of Suspended Solids, Wilton Creek, Ontario,	Climatic and Anthropogenic Effects on the Sedi- mentation and Geochemistry of Lakes Bourget, Annecy and Leman,
Water Resources Data, New Hampshire and Vermont, Water Year 1982,	W85-02056 2H	W85-02102 2H
W85-01933 2E	SWAMPS	TAMAR ESTUARY
Water Resources Data, Arkansas, Water Year	Soils of Swamps in the Apalachicola, Florida, Estuary,	Statistical Analysis of Estuarine Profiles: II Ap- plication to Arsenic in the Tamar Estuary (S.W.
1982,	W85-01641 2L	England),
	Hydrogeologic Investigation of Agana Swamp	W85-01914 5B
Water Resources Data, Massachusetts and Rhode Island, Water Year 1982,	Northern Guam,	TANANA RIVER
W85-01935 2E	W85-02029 2F	Sediment Transport in the Tanana River near Fairbanks, Alaska, 1982,
Water Resources Data, North Dakota, Water	SWEDEN	W85-01769 2J
Year 1982,	Lake Trehorningen Restoration Project. Changes in Water Quality after Sediment	TCDD
W85-01936 2E	Dredging,	Determination of 2,3,7,8-Tetrachlorodibenzo-p-
Water Resources Data, South Carolina, Water	W85-02097 5G	Dioxin in Treated Wastewater,
Year 1982,	SWIMMING	W85-01729 5A
W85-01937 2E	Evaluation of the Visibility Criterion of the Mas-	TEMPERATURE
Water Resources Data, Georgia, Water Year	sachusetts Sanitary Code for Swimming in Natu- ral Waters.	Effects of the Herbicide Atrazine on an Oyster- Food Organism,
1982, W85-01938 2E	W85-01800 6E	W85-01808 5C
Water Resources Data, Alabama, Water Year	SWITZERLAND	TENNESSE
1982,	Report on Hydroelectric Power Utilization and Reserved-Water Problems (Bericht uber Was-	Drought in Southeastern United States,
W85-01939 2E	serkraftuntzung und Restwasserprobleme).	W85-01642 2B
SURFACE WATERS	W85-01855 4A	TENSION Shartnile Interlege Tension in Colluber Coffee
Enteric Virus Levels in Wastewater Effluents and Surface Waters in the Severn Trent Water	Origin of Nitrates in Groundwater of the Bunz	Sheetpile Interlock Tension in Cellular Coffer- dams.
Authority 1979-1981,	Valley (Woher stammen die Nitrate im Grun-	W85-01872 8A
W85-01718 5B	wasser des Bunztales), W85-01856 5B	TEST HOLE
Results of Surface-water, Dyke, and Coastal In-		Data for Ground-Water Test Hole near Nico-
spection - Ways Toward More Effective In- spection for the Future,	Rebuilding of the Hydro-Electric Power Station of Spiez (Kraftwerk Spiez Erneuerung 1982-	laus, Central Valley Aquifer Project, California W85-01929 70
W85-01874 4A	1985),	
Water Resources Data, Kentucky, Water Year	W85-01857 8A	Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California
1982,	Asynchronous Generator; An Alternative to the	W85-01941 7C
W85-01923 2E	Synchronous Generator for Small Hydroelectric Power Stations with Output up to 20,000 kW	TEST WELLS
SURFACTANTS	(Der Asynchrongenerator; Eine Alternative zum	Instrumentation Used for Hydraulic Testing of
Adsorption of Surfactants on Sediments, W85-01960 5A	Synchrongenerator fur kleine Wasserkraftanla- gen mit einer Leistung bis 20000 kW),	Potential Water-Bearing Formations at the Waste Isolation Pilot Plant Site in Southeastern
	W85-01858 8C	New Mexico,
SURINAM Some Ecological Consequences of a Projected	Development of the Condition of the Baldegger-	W85-01827 71
Deep Reservoir in the Kabalebo River in Surin-	see (1900 to 1980) and the Effect of Intralake	TEXAS
ame, W85-01764 6G	Procedures (Die Zustandsentwicklung dis Bal- deggersees (1900 bis 1980) und die Auswirkung	Conventional Water Process Costs Studied, W85-01706 5D
SURVIVAL	von seeinternen Massnahmen),	Analysis of Aqueous Sediments for Heavy
Microorganism Survival in an Ice-Covered	W85-01865 5C	Metals,
River, W85-01708 5B	Hydroelectric Power Station at the Netstal Lime Factory (Das Wasserkraftwerk der Kalkfabrik	W85-01742 51
	Netstal AG),	Records of Wells, Drillers' Logs, Water-Leve
SUSAA RIVER Diurnal Variation in the Oxygen Uptake of	W85-01866 8A	Measurements, and Chemical Analyses of Ground Water in Chambers, Liberty, and Mont
River Sediments in Vitro by Use of Continuous	All About Ozone - Its Advantages and Disad-	gomery Counties, Texas, 1975-79,
Flow-Through Systems,	vantages in Treating Water,	W85-01818 21
W85-02069 2E	W85-01986 5F	Records of Wells, Drillers' Logs, Water-Leve
SUSPENDED SEDIMENTS	Geochemistry of the Rhine and the Rhone and	Measurements, and Chemical Analyses of
Elemental Composition of Suspended Particles From the Yellow and Yangtze Rivers,	Human Impact (La Geochimie du Rhin et du Rhone et L'impact Humain),	Ground Water in Brazoria, Fort Bend, an Waller Counties, Texas, 1975-79,
W85-01703 2J	W85-02059 2H	W85-01819 2

Water Quality of Lake Arlington on Village	TOXICITY	TRAVELING SCREENS
Creek, North-Central Texas, 1973 to 1981, W85-02042 2H	Influence of Acid Precipitation on Stream Inver- tebrates,	Traveling Screens as Sampling Gear for Vertical Distribution Studies,
Availability of Dissolved Oxygen in Interstitial	W85-01807 5C	W85-01842 7B
Waters of a Sandy Creek,	Effects of Copper and Cadmium on Growth,	TREES
W85-02103 2E	Swimming and Predator Avoidance in Euryte- mora affinis (Copepoda),	Waterlogging Tolerance of Lowland Tree Species of the South.
THAMES	W85-01900 5C	W85-02111 2I
Modeling Algal Behaviour in the River Thames,	***************************************	W 65-02111 21
W85-01720 5G	Toxicity of Organic Mixtures Saturated in Water	TRIAZINE PESTICIDES
THANA CREEK	to Daphnia magna. Effect of Compositional	Effects of the Herbicide Atrazine on an Oyster-
Pollution Effects Monitoring With Foraminifera	Changes, W85-01953 5C	Food Organism,
as Indices in the Thana Creek, Bombay Area,	W83-01933	W85-01808 5C
W85-01671 5C	Analysis of Aquatic Toxicity Data: Water Solu-	TRICHLOROACETIC ACID
THERMAL POLLUTION	bility and Acute LC50 Fish Data,	Determination of Organohalogenic Acids in
Occurrence of the Asiatic Clam Corbicula flu-	W85-01966 5C	Water Samples (Bestimmung Halogenorgan-
minea in the Maumee River and Western Lake	Solubility of Organic Mixtures in Water,	ischer Sauren in Wasserproben),
Erie,	W85-02109 5B	W85-01663 5A
W85-01753 5C	Look of Norhestanisis, in the Bet he Coding	TRICHLOROANILINE
THERMAL SPRINGS	Lack of Nephrotoxicity in the Rat by Sodium Chlorite, a Possible Byproduct of Chlorine Di-	Microbial Degradation of 2,4,6-Trichloroaniline
Hydrogeochemical Investigation of Thermal	oxide Disinfection in Drinking Water,	in Aquatic Samples and Laboratory Enrichment
Springs in the Black Canyon-Hoover Dam Area,	W85-02119 5F	Cultures,
Nevada and Arizona, W85-01804 2K	7.1	W85-02120 5B
W85-01804 2K	Laboratory Assessment of the Toxicity of Urban Runoff on the Fathead Minnow (Pimephales	TRIHALOMETHANES
THERMAL WATER	promelas),	Ann Arbor Controls Trihalomethanes,
Change in Quality of Thermal Groundwater	W85-02124 5C	W85-01911 5F
From a Unique Resource in Lebanon,		manus. T
W85-01673 2F	TRACE METALS Metal Speciation in Surface Waters of the Great	TRINIDAD Design Storm for a Tropical Location with Lim-
Hydrogeochemical Investigation of Thermal	Lakes Region,	ited Data,
Springs in the Black Canyon-Hoover Dam Area,	W85-01811 5A	W85-01678 2B
Nevada and Arizona, W85-01804 2K		
W85-01804 2K	Control of Metal Contaminants in Drinking	TRINO VERCELLESE
TIDAL EFFECTS	Water in Denmark, W85-01993 5F	Groundwater Response under an Electronuclear
Tidal and Seasonal Variations of Sulfate Ion in a	1103-01773	Plant to a River Flood Wave Analyzed by a Nonlinear Finite Element Model.
New Jersey Marsh System, W85-01848 5B	TRAINING	W85-02157 2F
W63-01646 3B	Training Programmes in Federal Systems of	
TIDAL MARSHES	Government, W85-01989 6F	TRIPTON
Fluxes of Heavy Metals in Delaware River	W 63-01767	Sedimentation Rates in a Swiss-Italian Lake Measured with Sediment Traps,
Freshwater Tidal Wetlands, W85-01805 5B	Water Resources Division Training Catalog,	W85-02100 2J
W 03-01003	W85-02032 9B	
TIRES	TRANSMISSIVITY	TRITIUM
Mechanisms of Metal Adsorption from Aqueous Solutions by Waste Tyre Rubber,	Instrumentation Used for Hydraulic Testing of	Hydrogeochemical Investigation of Thermal Springs in the Black Canyon-Hoover Dam Area,
W85-01724 5D	Potential Water-Bearing Formations at the	Nevada and Arizona,
	Waste Isolation Pilot Plant Site in Southeastern,	W85-01804 2K
TIWI	New Mexico, W85-01827 7B	
Effects of Acidification on the Ecology of Streams in the Upper Tywi Catchment in West		TROPHIC DYNAMICS
Wales,	Aquifer Tests in the Stratified Drift, Chipuxet	Trophic Ecology of Fish Rearing Ponds, W85-01833 2H
W85-02116 5C	River Basin, Rhode Island,	W 65-01055
TOGIAK RIVER BASIN	W85-02039 2F	TROPHIC LEVEL
Reconnaissance of Surface Water Resources in	Parameter Identification of Groundwater Aqui-	Deepwater Sediments and Trophic Condition
the Togiak River Basin, Southwestern Alaska,	fer Models: A Generalized Least Squares Ap-	in Florida Lakes, W85-02099 2H
1980 and 1982,	proach,	W 83-02099
W85-01777 2A	W85-02164 2F	TROPHIC LEVELS
TOLO HARBOR	Application of the Geostatistical Approach to	Trophic Ecology of Fish Rearing Ponds,
Heavy Metals in Ulva lactuca Collected within	the Inverse Problem in Two-Dimensional	W85-01833 2F
Tolo Harbour, An Almost Landlocked Sea,	Groundwater Modeling, W85-02169 2F	TROPICAL REGIONS
W85-01762 5B	W 63-02109 21	Design Storm for a Tropical Location with Lim
TORTS	TRANSPIRATION	ited Data,
Tort Recovery of Acid Rain Damages in the	Water-Use Production Functions of Selected	W85-01678 2I
United States - Observations on Plaintiff's Prima	Agronomic Crops in Northwestern New Mexico, Phase II,	Potable Water Treatment in Tropical Countries
Facie Case, W85-01667 6E	W85-01817 3F	Recent Experiences and Some Technologica
11.03-01007 OE		Trends,
TOWN CREEK	TRANSPORT	W85-02022 51
Transport of Dissolved Organic Carbon through	Transport of Iron and Manganese in Relation to the Shapes of Their Concentration-Depth Pro-	TUNNELING
a Major Creek of the North Inlet Ecosystem, W85-01766 2L	files,	World's Longest Tunnel,
	W85-02090 2K	
TOXIC SUBSTANCES		
Use of Fixed-Bed Adsorber Models to Predict	TRAPPING Singlet Oxygen in Surface Waters - Part I: Fur-	TURBIDITY Water Temperature and Turbidity in Glaciall
the Fluxes of Toxic Substances in Groundwaters and Soil Environments,	furyl Alcohol as a Trapping Agent,	Fed Lake Tekapo,
W85-01793 5B		

TURBIDITY

Effect of Low Dissolved Oxygen Concentration on Effluent Turbidity, W85-01653 5D	URBAN HYDROLOGY Univariate Versus Multivariate Rainfall Statistics - Problems and Potentials,	VAPORIZATION Water Hyacinth Canopy and Pan Evaporation, W85-02128 4A
TURBULENT FLOW Mechanics of Mudflows, W85-01816 8B	W85-01685 2B Staged Approach to Application of Rainfall Data to Urban Runoff Calculations, W85-01694 2E	VEGETABLE CROPS Vegetation and Water Chemistry of Four Oligo- trophic Basin Mires in Northwestern Ontario, W85-01648 2H
TWO-COMPONENT EXTREME VALUE Two-Component Extreme Value Distribution for Flood Frequency Analysis, W85-02151 2E TWO-DIMENSIONAL MODEL	URBAN RAINFALL Potential Urban Rainfall Prediction Measurement System, W85-01701 2B	W85-01648 2H VEGETATION Erosion Control at High Altitudes (Erosionsbekampfung im Hochgebirge), W85-01863 4D
Computer Program and Data Listing for Two- Dimensional Ground-Water Model for Laramie County, Wyoming, W85-01787 7C	URBAN RUNOFF Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban Runoff Program,	VERMONT Microbial Contamination of Potable Water in Distribution Systems,
ULTRAFILTRATION Evalution of Hollow Fiber Ultrafiltration as a Pretreatment for Reverse Osmosis Desalination of Seawater,	W85-01661 5A Rainfall as the Basis for Urban Runoff - Experience and Practice in Yugoslavia, W85-01682 2B	W85-01796 5F Water Resources Data, New Hampshire and Vermont, Water Year 1982, W85-01933 2E
W85-01830 3A ULTRAPURE WATER State-of-the-Art for Electronic Grade Ultrapure Water Manufacturing and Distribution, Part I,	Depth-Duration Models of Short Time Increment Rainfall, W85-01683 2B	VERTICAL DISTRIBUTION Vertical Temperature Distribution in Lakes, W85-01651 2H
W85-01873 5F ULTRAVIOLET RADIATION Ultraviolet Disinfection of Secondary Effluent,	Staged Approach to Application of Rainfall Data to Urban Runoff Calculations, W85-01694 2E	Traveling Screens as Sampling Gear for Vertical Distribution Studies, W85-01842 7B
W85-01654 5D Mixing Effects in UV Disinfection, W85-01659 5D	Rainfall Data For the Design of Detention Basins, W85-01695 2E	VIENNA Runoff from Utility Waste Landfill to be Recycled from Detention Basin to Scrubber Make- Up,
Ultraviolet Disinfection of Water, W85-02020 5D	Overflow Data of Rainwater Discharge Systems Determined From Run Off Simulation of Plu- viograph Records,	W85-01849 5D VIRGIN ISLANDS
UNCONFINED AQUIFERS Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near the East Unit, Indiana Dunes National Lake- shore, Indiana, 1982, W85-01948 4A	W85-01698 2E Methods For Calculation of Annual and Extreme Overflow Events From Combined Sewer Systems, W85-01699 2E	Land Use, Runoff and Recharge on Selected Watersheds in the U.S. Virgin Islands, W85-01799 4C Effects of Runoff from Undeveloped Versus Lightly Developed Watersheds on Tropical
UNIT HYDROGRAPH Magnitude and Frequency of Floods from Urban Streams in Leon County, Florida, W85-02047 4A	Flood-Frequency Estimates for Five Gaged Basins in Wichita, Kansas, W85-01949 2A Calibration and Verification of a Rainfall-Runoff	Planktonic Ecosystem, W85-01810 5C VIRGINIA Annual Cycle of Kepone Residue and Lipid
URACH Kinetic Factors of CaCO3-Precipitation and the Partitioning of 12C and 13C. Studies at the Wa- terfalls of Guterstein and Urach (Schwabische Alb) (Kinetische Faktoren der CaCO3-Abscheidung und der Fraktionierung von 12C und 13C. Untersuchungen an den Wasserfallen von Guter-	Model and a Runoff-Quality Model for Several Urban Basins in the Denver Metropolitan Area, Colorado, W85-02044 2A Urban Runoff as a Source of Polycyclic Aro- matic Hydrocarbons to Coastal Waters,	Content of the Estuarine Clam, Rangia cuneata, W85-01846 5C Acute Toxicity of Kepone to Selected Freshwater Fishes, W85-01846 5C Kepone Concentration in Juvenile Anadromous
stein und Urach (Schwabische Alb)), W85-01662	W85-02108 5B Laboratory Assessment of the Toxicity of Urban	Fishes, W85-01847 5B
URANIUM Metal Speciation in Surface Waters of the Great Lakes Region, W85-01811 5A	Runoff on the Fathead Minnow (Pimephales promelas), W85-02124 5C Effects of Urbanization on Frequencies of Over-	Uptake of Kepone from Sediment Suspensions and Subsequent Loss by the Oyster Crassostrea virginia, W85-01897 5B
URANIUM MILLS Model for Instream Regulation of Radioisotopes and Heavy Metals in Riverine Waters Subjected to a Uranium Mill Discharge,	flows and Pollutant Loadings from Storm Sewer Overflows: A Derived Distribution Approach, W85-02152 5B URBAN WATERSHED	Pump Station Design: The Benefits of Computer Modeling, W85-01905 8C
W85-02068 5B URANIUM MINING Distribution and Concentrations of Naturally- Occurring Radionuclides in Sediments in a Ura-	Effect of Various Hydrologic Parameters on the Quality of Stormwater Runoff from a West La- fayette, Indiana Urban Watershed, W85-01822 5B	VOLATILITY Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico, W85-01963 5E
nium Mining Area of Northern Saskatchewan, Canada, W85-02083 5B URBAN DRAINAGE	Review of the Water Supply in the Soviet Union,	VOLATILIZATION Removal of Volatile Organic Pollutants from Rapid Streams, W85-01738 5B
DRBAN DRAINAGE Design Storm for a Tropical Location with Limited Data, W85-01678 2B	UTAH Three-Dimensional Digital-Computer Model of	VOLUME-AVERAGED CONCENTRATIONS Flux-Averaged and Volume-Averaged Concen-
Evaluation of Urban Design Storm Sensitivity, W85-01693		trations in Continuum Approaches to Solute Transport, W85-02153 2F

WABIGOON RIVER Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal	Identification of Nonionic Detergents by GC/ CI-MS: I. A Complementary Method or an At- tractive Alternative to GC/EI-MS and Other	Initial Studies on the Use of High-Performance Liquid Chromatography for the Rapid Assess- ment of Sewage Treatment Efficiency,
and Regional Variations,	Methods,	W85-01721 5D
W85-02091 5B	W85-01955 5A	Material Balance Analysis for Fluoride Ions in
WAIOHEWA STREAM Water Quality of the Waiohewa Stream, Ro-	Organization and Evaluation of Interlaboratory Comparison Studies among Southern African	Experimental Waste Disposal Plant, W85-01732 5D
torua, W85-01634 5B	Water Analysis Laboratories, W85-02117 5A	Wastewater Treatment with Aerated Submerged
WALES	Simultaneous Concentration of Four Enterovir-	Biological Filters,
Effects of Acidification on the Ecology of Streams in the Upper Tywi Catchment in West	uses from Tap, Waste, and Natural Waters, W85-02137 5A	W85-01736 5D
Wales,		Blue Crab Processing Plant Effluent Treatment, W85-01741 5D
W85-02116 5C	WASTEWATER DISPOSAL Restoration of Failing On-Site Wastewater Dis-	
WASHINGTON	posal Systems Using Water Conservation,	Organic and Inorganic Mercury Species in the Ft. Lewis Solvent Refined Coal Pilot Plant
Flood Elevations for the Soleduck River at Sol Duc Hot Springs, Clallam County, Washington,	W85-01656 5D Disposal of Household Wastewater in Soils of	Water Treatment Process, W85-01798 5D
W85-01773 4A	High Stone Content (1981-1983),	
Breeding Mallard (Anas platyrhynchos) Habitat Suitability Model,	W85-01815 5D	Investigation of Photocatalytic Oxidation for Wastewater Cleanup and Reuse,
W85-01792 6G	Development and Field Testing of a Methodolo-	W85-01813 5D
Fluoride, Nitrate, and Dissolved-Solids Concen-	gy for Assessing Community Readiness for Self-Help in the Installation, Maintenance and	State-of-the-Art of the Electrodialysis Reversal
trations in Ground Waters of Washington,	Repair of Water Supply and Sanitation Facili-	(EDR) Process,
W85-01828 2F	ties, W85-01980 7C	W85-01851 5D
Hydrocarbons in Washington Coastal Sedi-		Reduction of Costs and Liability Risks in Elec-
ments, W85-01915 5B	WASTEWATER DISPOSAL FIELDS Disposal of Household Wastewater in Soils of	troplating Wastewater Treatment, W85-01852 5D
Occurrence, Quality, and Use of Ground Water	High Stone Content (1981-1983), W85-01815 5D	Wastewater Purification as Related to the Study
in Orcas, San Juan, Lopez, and Shaw Islands,	W85-01815 5D	of a River System (Abwasserreiningung in Ver-
San Juan County, Washington,	WASTEWATER EFFLUENTS	bindung mit der Untersuchung eines Flusssys-
W85-02043 7C Seasonal Study of Methane Oxidation in Lake	Effect of Various Hydrologic Parameters on the Quality of Stormwater Runoff from a West La-	tems), W85-01885 5D
Washington,	fayette, Indiana Urban Watershed, W85-01822 5B	Sedimentation Success from Modified Jar Tests,
W85-02134 2H		W85-01910 5F
WASTE DISPOSAL	WASTEWATER FACILITIES Mixing Effects in UV Disinfection,	Intensification of Wastewater and Sludge Treat-
Irrigation of Public Use Areas by Land Applica- tion of Combined Industrial and Domestic	W85-01659 5D	ment Processes Through Utilization of the Energy Potential of Wastewater (Intensivierung
Waste Effluent, W85-01740 5D	Pumps for Liquids, Especially for Wastewater (Pumpen fur Flussigkeiten, insbesondere fur Ab- wasser).	der Abwasser-und Schlammbehandlingsprozesse durch nutzung des Eigenenergiepotenitals der
Runoff from Utility Waste Landfill to be Recycled from Detention Basin to Scrubber Make-	W85-01864 8C	Abwasser), W85-01970 5D
Up,	WASTEWATER IRRIGATION	Enzymatic Hydrolysis Tests on an Industrial
W85-01849 5D	Irrigation of Public Use Areas by Land Applica- tion of Combined Industrial and Domestic	Effluent Prior to its Biological Purification (Essais d'Hydrolyse Enzymatique d'un Effluent
Waste Management Scenarios for Minnesota's Twin Cities,	Waste Effluent, W85-01740 5D	Industriel avant son Epuration Biologique),
W85-01867 5E		W85-01975 5D
Volatile Organic Inputs from an Ocean Outfall	WASTEWATER POLLUTION Impact of Domestic Sewage Pollution on Enzy-	Biological Fouling of Reverse Osmosis Mem-
Near Barceloneta, Puerto Rico,	matic Activities of Two Planktonic Copepods	branes,
W85-01963 5E	(Acartia clausi and Centropages typicus)	W85-01977 5D
WASTEWATER	(Impact d'une Pollution d'Origine Urbaine sur les Activites Enzymatiques de deux Copepodes	Use of Artifical Wetlands to Remove Nitrogen
MINES: A Model to Forecast Mine Wastewater Quality,	Planctoniques (Acartia Clausi et Centropages typicus)),	Compounds from Wastewater, W85-01978 5D
W85-01750 5B	W85-01898 5C	Mechanism of Semifluidized Bed Bioreactor for
Analysis of Quantitative Wastewater Measure- ments of a Country Restaurant Situated at Ap-	WASTEWATER TREATMENT	Biological Phenol Degradation, W85-02106 5D
proximately 1080 m Altitude and of a Mountain Inn Situated at Approximately 1410 m Altitude	Effect of Low Dissolved Oxygen Concentration on Effluent Turbidity,	
(Auswertung von Schmutzwasser-Mengenmes-	W85-01653 5D	WASTEWATER TREATMENT FACILITIES Construction of Rationalization Equipment at
sungen bei einem Ausflugsrestaurant, rund 1080 m u. M. und bei einem Berggasthof, rund 1410 m	Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D	the Rostock Water-Supply and Wastewater- treatment Facility (Rationalisierungsmittelbau
u. M.), W85-01854 5D	Two-Stage Biological Fluidized Bed Treatment	im VEB Wasserversorgung und Abwasserbe- handlung Rostock),
Effect of Chlorination on Antibiotic Resistance	of Coke Plant Wastewater for Nitrogen Control, W85-01655 5D	W85-01877 5F
Profiles of Sewage-Related Bacteria, W85-02139 5D	Pilot Plant Demonstration of Biological Phos-	Energy Studies of Wastewater-Treatment Facili- ties as a Basis for Optimal Energy Use (Ener-
WASTEWATER ANALYSIS	phorus Removal, W85-01657 5D	giestudien von Abwasserbehandlingsanlagen als
Determination of 2,3,7,8-Tetrachlorodibenzo-p-		Grundlage fur den optimalen Energieeinsatz),
Dioxin in Treated Wastewater, W85-01729 5A	Nonsteady-State-Biofilm Process for Advanced Organics Removal,	W85-01878 5D Friedrichtoda Wastewater Treatment Facility
Metals Distributions in Activated Sludge Sys-	W85-01658 5D	Results of an Experiment (Klaranlage Friedrich-
tems,	Conventional Water Process Costs Studied,	roda - Ergebnisse eines Experiments),
W85-01737 5D	W85-01706 5D	W85-01884 5D

WASTEWATER TREATMENT FACILITIES

Reduction of the Use of Materials with the Aid of Science and Technology at the Hydrotechno-	WATER DISTRIBUTION Computerized Distribution Records- CADD	Ground Water in Chambers, Liberty, and Mont- gomery Counties, Texas, 1975-79,
logy and Water-Management-Planning Combine (Senkung des Produktionsverbrauchs mit Hilfe	Paves the Way, W85-01902 5F	W85-01818 2F
von Wissenschaft und Technik im VEB Kom- binat Wassertechnik un Projektierung Wasser-	Microcomputer Programs for Designing Water	Water-Level Maps of the Alluvial Aquifer, Northwestern Mississippi, April, 1982,
wirtschaft),	Systems,	W85-01926 7C
W85-01968 5D	W85-01903 8A	WATER LOSS
WATER ANALYSIS	Computer Modeling in Water System Planning	Leakage Control,
Determination of 4-Aminophenol in Water by	and Design,	W85-02016 3D
High-Performance Liquid Chromatography	W85-01906 5F	
with Fluorescence Detection,		Water Hyacinth Canopy and Pan Evaporation,
W85-01746 5A	Computer-Assisted Water System Analysis and Design for Charleston, S.C.,	W85-02128 4A
Quantitative Determination of ppb Levels of	W85-01907 5F	WATER MAINS Comparison of Water Mains Cleaning Tech-
Carbamate Pesticide in Water by Capillary Gas	Development and Field Testing of a Methodolo-	niques - The Experiment of Begles (Comparai-
Chromatography, W85-01747 5A	gy for Assessing Community Readiness for Self-Help in the Installation, Maintenance and	son des Techniques de Curage des Conduites d'Eau Potable - L'Experience de Begles),
Determination of Aldicarb and its Derivatives in	Repair of Water Supply and Sanitation Facili-	W85-01999 8A
Groundwaters by High-Performance Liquid	ties,	
Chromatography with UV Detection,	W85-01980 7C	WATER MANAGEMENT
W85-01748 5A	Bacteria in Works and Mains from Ground	XXVI CFMT - Exhibition of Scientific and Technical Achievement of Youth in the Water-
Online Assessment Posts for Postine Water	Water Supplies,	management Industry,
Quality-Assurance Data for Routine Water Analysis in the Laboratories of the U.S. Geolog-	W85-02001 5F	W85-01875 5G
ical Survey for Water-Year 1982, W85-01768 7C	Remote Monitoring and Optimisation of Pump-	Rationalization of Central Planning in Water
W85-01768 /C	ing at the Syndicat des Eaux of La Haute-Loue	Management Through the Introduction of EDP
Singlet Oxygen in Surface Waters - Part II:	(Telesurveillance et Optimisation du Pompage	(Rationalizierung der zentralen Planung in der
Quantum Yields of Its Production by Some Nat-	du Syndicat des Eaux de La Haute-Loue), W85-02005 5F	Wasserwirtschaft durch Einsatz der EDV), W85-01879 7C
ural Humic Materials as a Function of Wave-	W 65-02005	W83-01879
length, W85-01965 2K	Towards Total Automation of Water Distribu-	Training Programmes in Federal Systems of
W85-01905 2K	tion (Vers l'Automatisation Integrale dans la	Government,
Determination of Phenols in Water Using	Distribution d'Eau),	W85-01989 6F
Raman Spectroscopy,	W85-02009 6A	Report on the Water Supply of the People's
W85-02114 5A	Case for Automated Water Management,	Republic of China,
Organization and Evaluation of Interlaboratory	W85-02130 6A	W85-01995 5F
Comparison Studies among Southern African	WATER HYACINTH	Towards Total Automation of Water Distribu-
Water Analysis Laboratories,	Water Hyacinth Canopy and Pan Evaporation,	tion (Vers l'Automatisation Integrale dans la
W85-02117 5A	W85-02128 4A	Distribution d'Eau),
WATER BUDGET		W85-02009 6A
Developing the Resource Potential of a Shallow	WATER LEVEL Association between Net Basin Supplies to Lake	Matara Water Supply Project in Sri Lanka,
Water Table,	Superior and Supplies to the Lower Great	W85-02013 5F
W85-01832 3B	Lakes,	
WATER CONSERVATION	W85-01755 2H	Case for Automated Water Management,
Restoration of Failing On-Site Wastewater Dis-	Water Lavel More of the Alluvial Assistanta	W85-02130 6A
posal Systems Using Water Conservation,	Water-Level Maps of the Alluvial Aquifer in Northwestern Mississippi, April 1983,	Managing Water Scarcity: An Evaluation of In-
W85-01656 5D	W85-01944 7C	terregional Transfers, W85-02145 6F
State Laws Mandating Water Conservation,	Forecasting of Water Level and Discharge of	
W85-01806 6E	the Elbe with the Aid of Fuzzy Modelling (Vor-	Use of Models for Water Resources Manage-
Results and Experience of the Greiz Water-	hersage von Wasserstand und Durchfluss fur die	ment, Planning, and Policy, W85-02146 6A
Supply District in the Field of Rational Water	Elbe mit Hilfe einer unscharfen Modellierung), W85-01973 2E	W 83-02140
Use (Ergebnisse und Erfahrungen des Versor-	W85-01973 2E	WATER MANAGEMENT (APPLIED)
gungsbereichs Greiz bei der rationellen Wasser-	Geohydrologic Data for Test Well USW G-4,	Hydrogeology of Well-Field Areas near Tampa,
verwendung), W85-01880 3D	Yucca Mountain Area, Nye County, Nevada, W85-02031 7C	Florida, Phase 2Development and Documenta- tion of a Quasi-Three-Dimensional Finite-Differ-
Water Conservation through Limited Irrigation	WATER-LEVEL FLUCTUATION	ence Model for Simulation of Steady-State Ground-Water Flow,
of Corn and Grain Sorghum in the Great Plains,	Data for Ground-Water Test Hole Near Butte	W85-02052 2F
W85-01952 3F	City, Central Valley Aquifer Project, California,	
WATER CONVEYANCE	W85-01941 7C	WATER POLICY
WATER CONVEYANCE Calibrating Water System Models,	WATER I PURE DELICITIATIONS	New Ecological Approach to the Water Cycle
W85-01904 5F	WATER-LEVEL FLUCTUATIONS Data for Ground-Water Test Hole near Nico-	Ticket to the Future, W85-01704 6A
-	laus, Central Valley Aquifer Project, California,	
Status of Research and Development in Water	W85-01929 7C	WATER POLLUTION
Supply Systems in India,		Automated Sensor Systems for Water Resource
W85-01982 3D	WATER LEVELS	Pollution Warning and Treatment Process Con- trol.
WATER DEMAND	Machine-Readable Data Files from the Madison Limestone and Northern Great Plains Regional	W85-02010 5F
New Ecological Approach to the Water Cycle:	Aquifer System Analysis Projects, Montana, Ne-	
Ticket to the Future,	braska, North Dakota, South Dakota, and Wyo-	WATER POLLUTION CONTROL
W85-01704 6A	ming,	Wastewater Purification as Related to the Study
Competition Versus Optimal Control in Ground-	W85-01790 7C	of a River System (Abwasserreiningung in Ver- bindung mit der Untersuchung eines Flusssys
water Pumping when Demand is Nonlinear,	Records of Wells, Drillers' Logs, Water-Level	tems),
W85-02141 4B	Measurements, and Chemical Analyses of	W85-01885 5E

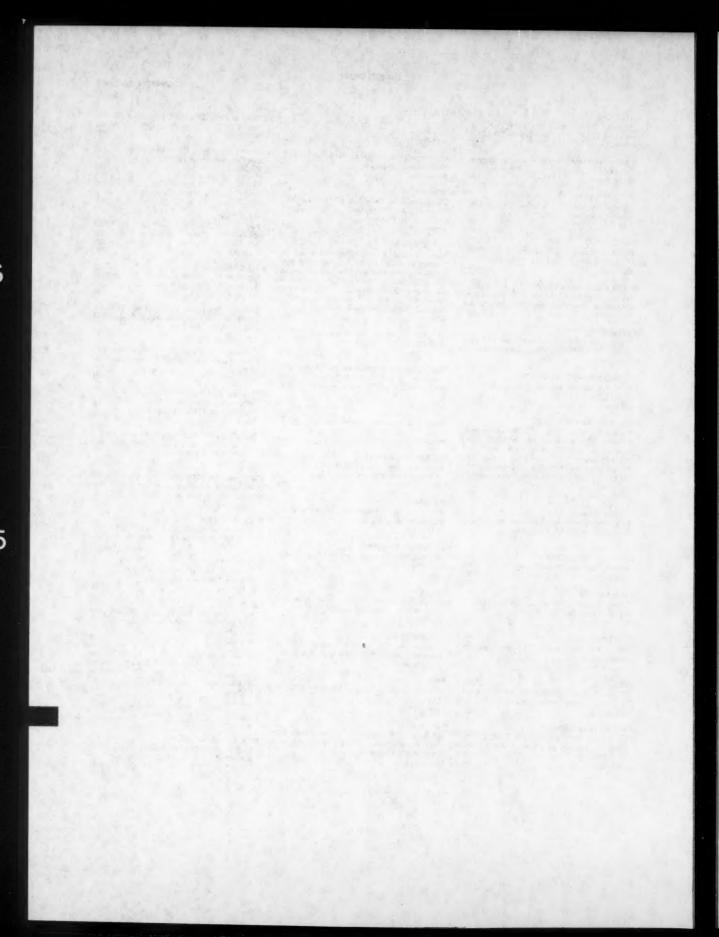
5D

WATER POLLUTION EFFECTS Organic Wastewater Effects on Benthic Inverte- brates in the Manawatu River,	Water Quality of the Waiohewa Stream, Rotorua, W85-01634 5B	Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined Areas of Southeastern Kansas,
W85-01632 5C	Statistical Analysis and Evaluation of Water-	W85-01947 5B
Oil Spill Focuses Attention on the Problems of a	Quality Data for Selected Streams in the Coal	Water Quality of Lake Arlington on Village
Man-Made Recreational Lake, W85-01650 5B	Area of East-Central Montana, W85-01770 5B	Creek, North-Central Texas, 1973 to 1981, W85-02042 2H
Pollution Effects Manitoring With Resemblifers		
Pollution Effects Monitoring With Foraminifera as Indices in the Thana Creek, Bombay Area, W85-01671 5C	Reconnaissance of Surface Water Resources in the Togiak River Basin, Southwestern Alaska,	Occurrence, Quality, and Use of Ground Water in Orcas, San Juan, Lopez, and Shaw Islands,
	1980 and 1982, W85-01777 2A	San Juan County, Washington, W85-02043 7C
Effects of Ammonium Effluents on Planktonic Primary Production and Decomposition in a	W65-01777	
Coastal Brackish Water Environment. I. Interre- lations Between Abiotic and Biotic Components	Origins and Distribution of Saline Ground Waters in the Floridan Aquifer in Coastal Southwest Florida,	Calibration and Verification of a Rainfall-Runoff Model and a Runoff-Quality Model for Several Urban Basins in the Denver Metropolitan Area,
of the Planktonic Ecosystem, W85-01840 5C	W85-01778 2K	Colorado,
107. 8. 3.45.	Hydrologic Responses of Stream's to Mining of	W85-02044 2A
Trophic Response of Fishes to Habitat Variabili- ty in Coastal Seagrass Systems,	the Mulberry Coal Reserves in Eastern Kansas,	Land Use Effects on Sediment Yield and Qual-
W85-01890 2L	W85-01782 2E	ity, W85-02060 6G
Environmental and Biochemical Investigation of	Ground-water Quality in the Western Snake	
Some Effects of Organic Pollution in Inner Os-	River Basin, Swan Falls to Glenns Ferry, Idaho,	Lake Trehorningen Restoration Project.
lofjord, Norway, W85-01896 5C	W85-01784 2F	Changes in Water Quality after Sediment Dredging,
	XXVI CFMT - Exhibition of Scientific and	W85-02097 5G
Impact of Domestic Sewage Pollution on Enzy- matic Activities of Two Planktonic Copepods	Technical Achievement of Youth in the Water-	WATER QUALITY CONTROL
(Acartia clausi and Centropages typicus)	management Industry,	Fishable Waters Everywhere: An Appropriate
(Impact d'une Pollution d'Origine Urbaine sur	W85-01875 5G	Goal,
les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty-	Water Resources Data, Kentucky, Water Year	W85-01850 6B
picus)),	1982, W85-01923 2E	General Strategy for Security in Water Supply,
W85-01898 5C	Title of Change I Francisco on Water One lite	W85-01990 5G
Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi- ty and Physico-chemical Conditions in Compart-	Effects of Channel Excavation on Water-Quality Characteristics of the Black River and on Ground-Water Levels near Dunn, North Caroli-	Various Coating Materials for Potable Water Concrete Storage Reservoirs - Experiences in Germany, Switzerland and Austria,
ments of a Freshwater Pond,	na,	W85-02000 8G
W85-01967 5C	W85-01924 2A	Bacteria in Works and Mains from Ground
Effects of Acidification on the Ecology of Streams in the Upper Tywi Catchment in West	Annual Water-Resources Review, White Sands Missile Range, New Mexico, 1982, W85-01927 2E	Water Supplies, W85-02001 5F
Wales, W85-02116 5C		Water Supply in the Federal Republic of Ger-
WATER POLLUTION PREVENTION General Strategy for Security in Water Supply,	Distribution of Selected Chemical Constituents in Water from the Floridan Aquifer, Southwest Florida Water Management District,	many, W85-02002 6D
W85-01990 5G	W85-01928 7C	New Instrumentation in Automatic Water Quality Monitoring.
WATER POLLUTION SOURCES	Water Resources Data, Iowa, Water Year 1982,	W85-02007 5G
Influence of Rainfall Characteristics on the Pol- lution Emission,	W85-01931 2E	Appropriate Technology to Improve Drinking
W85-01697 2E	Water Resources Data, New Hampshire and Vermont, Water Year 1982,	Water Quality,
Municipal Solid-Waste Disposal and Ground-	W85-01933 2E	W85-02014 5F
Water Quality in a Coastal Environment, West- Central Florida,	Water Resources Data, Arkansas, Water Year	Drinking Water in Developing Countries - The
W85-01789 5E	1982,	Minimum Treatment Philosophy. A Case Study, W85-02018 3B
Contribution of Leaching of Diazinon, Parath-	W85-01934 2E	
ion, Tetrachorvinphos and Triazophos from	Water Resources Data, Massachusetts and	Chlorination of Cooling Waters and Quality of Water Resources,
Glasshouse Soils to Their Concentrations in	Rhode Island, Water Year 1982,	W85-02023 5D
Water Courses, W85-01961 5B	W85-01935 2E	WATER RESOURCES
	Water Resources Data, North Dakota, Water	Highlights of the 1983 Federal-State Coopera-
Urban Runoff as a Source of Polycyclic Aromatic Hydrocarbons to Coastal Waters,	Year 1982, W85-01936 2E	tive Water Resources Program, W85-01829 9D
W85-02108 5B		
Effects of Urbanization on Frequencies of Over-	Water Resources Data, South Carolina, Water	WATER RESOURCES DEVELOPMENT
flows and Pollutant Loadings from Storm Sewer Overflows: A Derived Distribution Approach.	Year 1982, W85-01937 2E	Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-
W85-02152 : 5B	Water Resources Data, Georgia, Water Year	ame,
WATER POLLUTION TREATMENT	1982,	W85-01764 6G
Effect of Treatment with a Commercial Bacterial Suspension on Water Quality in Channel	W85-01938 2E	Changes in the Fish Fauna of the Former Gre- velingen Estuary, before and after the Closure in
Catfish Ponds, W85-01922 5F	Water Resources Data, Alabama, Water Year 1982,	1971, W85-01765 6G
	W85-01939 2E	
WATER QUALITY Groundwater Quality Survey of an Unsewered, Semi-Rural Area,	Estimates of Dissolved and Suspended Substance Yield of Stream Basins in Michigan,	Rebuilding of the Hydro-Electric Power Station of Spiez (Kraftwerk Spiez Erneuerung 1982-1985),
W85-01633 5B	W85-01942 5A	W85-01857 8A

WATER RESOURCES DEVELOPMENT

Changes in the Naiad Fauna of the Cumberland River below Lake Cumberland in Central Ken- tucky.	Drinking Water in Developing Countries - The Minimum Treatment Philosophy. A Case Study, W85-02018	All About Ozone - Its Advantages and Disadvantages in Treating Water, W85-01986 5F
W85-01921 6G		
Economising Water and Fighting against Wastage (Economie d'Eau et Lutte contre le Gaspillage),	Feasibility Study of Developing Valley-Fill Aquifers for Village Water Supplies in Southern Guam, W85-02026 2F	Study of Mutagenic Activity in Water in a Pro- gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc- tion a Ozonation Estagee),
W85-01996 6B	WATER SUPPLY SYSTEMS	W85-01987 5F
Maximum Likelihood Estimates for the Parameters of Mixture Distributions, W85-02156 2E	General Strategy for Security in Water Supply, W85-01990 5G	First Experiences with a Women-Specific Project for the Water Decade,
	WATER-SURFACE PROFILES	W85-02004 5F
WATER RESOURCES PROJECTS Activities of the Alaska District, Water Resources Division, U.S. Geological Survey, 1984. W85-01825 10C	Floods of August 7-8, 1979, in Chautauqua County, New York, with Hydraulic Analysis of Canadaway Creek in the Village of Fredonia, W85-02051	Remote Monitoring and Optimisation of Pumping at the Syndicat des Eaux of La Haute-Loue (Telesurveillance et Optimisation du Pompage du Syndicat des Eaux de La Haute-Loue),
WATER REUSE	WATER TABLE	W85-02005 5F
Investigation of Photocatalytic Oxidation for Wastewater Cleanup and Reuse, W85-01813 5D	Water-Level Changes in the High Plains Re- gional Aquifer, Northwestern Oklahoma, Prede- velopment to 1980,	Appropriate Technology to Improve Drinking Water Quality,
	W85-01771 2F	W85-02014 5F
Yield and Quality of Cotton Grown with Wastewater, W85-01869 5D	Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg-	2001 The Future of Water Treatment (2001 L'Avenir du Traitement de l'Eau),
Irrigated Agricultural Expansion Planning in	wick, and Weld Counties, Colorado,	W85-02017 6A
Developing Countries: Investment Scheduling Incorporating Drainage Water Reuse,	W85-01775 2F WATER TEMPERATURE	Ultraviolet Disinfection of Water, W85-02020 5D
W85-02142 3F	Water Temperature and Turbidity in Glacially	Potential View of Francis or Catalogue in Daily
WATER SALINITY Developing the Resource Potential of a Shallow	Fed Lake Tekapo, W85-01637 2H	Potential Use of Enzymes as Catalysts in Drink- ing Water for the Oxidation of Taste Causing Substances.
Water Table,	Vertical Temperature Distribution in Lakes,	W85-02021 5F
W85-01832 3B	W85-01651 2H	Potable Water Treatment in Tropical Countries:
WATER STORAGE	WATER TREATMENT	Recent Experiences and Some Technological
Various Coating Materials for Potable Water Concrete Storage Reservoirs - Experiences in	Cost and Benefits of Drinking Water Treatment, W85-01649 5F	Trends, W85-02022 5F
Germany, Switzerland and Austria, W85-02000 8G	Status of Barrers Comerie un Ion Evaluate for	Current Water Treatment Practices in Western
Comparision of Water Catchment and Storage	Status of Reverse Osmosis vs. Ion Exchange for Petroleum/Petrochemical Utilities, W85-01853 5F	India - Case Studies of Two Metropolitan Cities, Bombay and Ahmedabad,
Systems in Two Micronesian Atoll Communi- ties: Laura and Nama,	State-of-the-Art for Electronic Grade Ultrapure	W85-02024 5F
W85-02028 6D	Water Manufacturing and Distribution, Part I, W85-01873 5F	Coagulation and Restabilization of Particulate, Macromolecular and Protected Organic Aqua-
WATER SUPPLY Report on the Water Supply of the People's		sols by Aluminum (III),
Republic of China, W85-01995 5F	Execution of Socialist Business Management in the Continuation of the Colbitz Movement (Die Durchsetzing der sozialistischen Betriebswirts-	W85-02105 5F Case for Automated Water Management,
Micro-Electronics in the Water Industry - A Review of Present and Probable Future Devel-	chaft in Fortfuhrung der Colbitzer Bewegung), W85-01876 5F	W85-02130 6A
opments,	Flocculation Model Testing: Particle Sizes in a	Instrumentation Control and Automation for Eccup Treatment Works,
W85-02008 6A	Softening Plant,	W85-02131 5F
Review of the Water Supply in the Soviet	W85-01908 5F	WATER TREATMENT FACILITIES
Union, W85-02012 5F	Ann Arbor Controls Trihalomethanes, W85-01911 5F	Chlorine as an Algicide in a Conventional Water Treatment Plant.
Leakage Control, W85-02016 3D	Observations from the Test Operation of an Ion-	W85-01749 5F
	exchange Facility for Nitrate Removal in Drink-	Construction of Rationalization Equipment at
Projected Public Supply and Rural (Self-Sup- plied) Water Use in Florida Through Year 2020, W85-02036 7C	ing-water Treatment (Erfahrungen aus dem Er- probengsbetrieb einer Ionenaustauscheranlage zur Nitratelimination in der Trinkwasseraufber-	the Rostock Water-Supply and Wastewater- treatment Facility (Rationalisierungsmittelbau im VEB Wasserversorgung und Abwasserbe-
WATER SUPPLY DEVELOPMENT	eitung), W85-01974 5F	handlung Rostock),
Appropriate Water Supply Technology for Developing Countries.	W85-01974 5F Quality Aspects of the Biesbosch Reservoirs,	W85-01877 5F
W85-01981 5F	W85-01979 5G	Data Bank for Waterworks and Facilities Goals and Problem-solving Concept (Datenbank
Water Decade (La Decennie de l'Eau), W85-01984 6B	Development and Field Testing of a Methodology for Assessing Community Readiness for	Wasserwerke und Anlagen - Aufgaben und Lo- sungskonzeption), W85-01969 5F
Training Programmes in Federal Systems of	Self-Help in the Installation, Maintenance and Repair of Water Supply and Sanitation Facili-	
Government, W85-01989 6F	ties, W85-01980 7C	Nice on the French Riviera - the Birthplace o Drinking Water Treatment with Ozone (Nice sur la Riviera Française - Berceau du Traitemen
Water Supply in the Federal Republic of Germany,	Practical Water Treatment for Communities in Developing Countries,	de l'Eau par l'Ozone), W85-01988
W85-02002 6D	W85-01983 5F	
Matara Water Supply Project in Sri Lanka, W85-02013 5F	Water Supply of Alexandria Egypt,	Practical Introduction of the Remote Control Systems and Process Control Facilities,
11000013	W85-01985 5F	W85-02006 6A

WATER USE	WELL WATER	WISCONSIN
Projected Public Supply and Rural (Self-Sup-	Groundwater Quality Survey of an Unsewered,	Seasonal Study of a Freshwater Lake and Mi-
plied) Water Use in Florida Through Year 2020,	Semi-Rural Area,	gratory Waterfowl for Campylobacter Jejuni,
W85-02036 7C	W85-01633 5B	W85-01639 5B
G	Geochemistry of Well Water and Cardiovascu-	Factors Structuring Fish Assemblages Along a
Competition Versus Optimal Control in Ground-	lar Diseases in Sri Lanka,	Bog Lake Successional Gradient,
water Pumping when Demand is Nonlinear, W85-02141 4B	W85-01674 5C	W85-01891 2H
W85-02141 4B	W83-010/4	
WATER USE EFFICIENCY	WEST BAY	Pesticides in Groundwater Beneath the Central
Stomatal Control of Water Use Efficiency in	Decomposition of Wild Rice (Zizania aquatica)	Sand Plain of Wisconsin, W85-02025 5B
Poplar Clones and Hybrids,	Straw in Two Natural Lakes of Northwestern	W83-02023
W85-01646 2I	Ontario,	WURAS DAM
	W85-01647 2H	Particle Size Distribution and Chemical Param-
WATER YIELD		eters of the Sediments of a Shallow Turbid Im-
Effect of Clear-Cut Silviculture on Dissolved	WEST GERMANY Kinetic Factors of CaCO3-Precipitation and the	poundment,
Ion Export and Water Yield in the Piedmont,	Partitioning of 12C and 13C. Studies at the Wa-	W85-02082 2H
W85-02171 5B	terfalls of Guterstein and Urach (Schwabische	WYOMING
WATER YIELD IMPROVEMENT	Alb) (Kinetische Faktoren der CaCO3-Abschei-	Impact of an Oil Field Effluent on Microbial
	dung und der Fraktionierung von 12C und 13C.	Activities in a Wyoming River,
Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains,	Untersuchungen an den Wasserfallen von Guter-	W85-01640 5C
W85-01952 3F	stein und Urach (Schwabische Alb)),	
W83-01932 3F	W85-01662 1B	Computer Program and Data Listing for Two-
WATERFOWL		Dimensional Ground-Water Model for Laramie
Seasonal Study of a Freshwater Lake and Mi-	Real-Time Estimation and Forecasting of Spa-	County, Wyoming, W85-01787 7C
gratory Waterfowl for Campylobacter Jejuni,	tially Distributed Areal Rainfall,	W65-01767
W85-01639 5B	W85-01700 2B	Evaluation of Fisherman Benefits Stemming
1100 01009	Study of Habitat Conditions of the Macrophytic	from Special Use Fishery Management Pro-
WATERLOGGING TOLERANCE	Vegetation in Selected River Systems in West-	grams,
Waterlogging Tolerance of Lowland Tree Spe-	ern Lower Saxony (Federal Republic of Germa-	W85-01831 6B
cies of the South,	ny),	YANGTZE RIVER
W85-02111 2I	W85-01887 2H	Elemental Composition of Suspended Particles
	W 05-01007	From the Yellow and Yangtze Rivers,
WATERSHED PROTECTION	Water Supply in the Federal Republic of Ger-	W85-01703 2J
Ensuring a High Level of Effectiveness and	many,	
Intensity of Agricultural and Water-Manage-	W85-02002 6D	226Ra and 228Ra in the Mixing Zones of the Pee
ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi-		Dee River-Winyah Bay, Yangtze River and
tat der landwirtschaftlichen und wasserwirts-	***************************************	Delaware Bay Estuaries, W85-01912 2L
chaftlichen Produktion in Trinkwasser-Einzugs-	Scasonar Meronians in Three Hypersamic Lances	W85-01912 2L
gebieten),	On Accument Intaline, Western Paustining,	YARRA RIVER ESTUARY
W85-01883 4D	W85-01645 2H	Aromatic Hydrocarbons in Waters of Port Phil-
	WETLANDS	lip Bay and the Yarra River Estuary,
WATERSHEDS	Fluxes of Heavy Metals in Delaware River	W85-01644 5B
Land Use, Runoff and Recharge on Selected	Freshwater Tidal Wetlands,	YELLOW RIVER
Watersheds in the U.S. Virgin Islands,	W85-01805 5B	Elemental Composition of Suspended Particles
W85-01799 4C		From the Yellow and Yangtze Rivers,
	WILDLIFE MANAGEMENT	W85-01703 21
WATERSHEDS (BASINS)	Breeding Mallard (Anas platyrhynchos) Habitat	
Drainage Basins in Duval County, Florida,	Suitability Model,	YUGOSLAVIA
W85-02046 70	W85-01792 6G	
WAVE ACTION	WILLIARD	ence and Practice in Yugoslavia, W85.01682
Design of Armour Systems for the Protection o		44 03-0100E
Rubble Mound Breakwaters,	Man-Made Recreational Lake,	ZINC
W85-01707 2		
	W 85-01050	Zinc by Asellus communis at Three Differen
WEATHER FORECASTING	WILTON CREEK	pH Levels,
Potential Urban Rainfall Prediction Measure	Physical and Geochemical Characteristics of	W85-01795 5I
ment System,	Suspended Solids, Wilton Creek, Ontario,	
W85-01701 21	W85-02056 2H	Bioavailability of Pb and Zn from Mine Tailing as Indicated by Erythrocyte delta-Aminolevu
WEDVOOR		linic Acid Dehydratase (ALA-D) Activity is
WEINZODL	WIND	Suchan (Disease Catastamidae)
Weinzodl Power Station on the Mur (Da	The second state of the se	W85-01918 54
Kraftwerk Weizodl an der Mur),	Case Study,	
W85-01860 8A	W85-01763 2H	Zane in water and bediments of 1 wo 1 miles
WELL HYDROGRAPH	WINYAH BAY	Lakes,
Exploratory Drilling and Aquifer Testing at th		W85-02065 51
Kipahulu District Haleakala National Parl		
Maui, Hawaii,	Delaware Bay Estuaries,	Trophic Ecology of Fish Rearing Ponds,
W85-01776 2		



AUTHOR INDEX

ABDEL-GAWAD, S. M. Hydrodynamic of Circular Primary Clarifiers, W85-01716 5D	ANDERSON, B. C. Aerobic Studge Digestion with pH Control - Preliminary Investigation, W85-01660 5D	BAGDE, U. S. Distribution and Periodicity of Total, Faecal Colform Bacteria in an Aquatic Ecosystem, W85-01675 5B
ABRAHAMS, A. D. Objective Identification of Pools and Riffles, W85-02159 2E	ANDREWS, F. L. Water Quality of Lake Arlington on Village	Influence of Physico-Chemical Factors on the Coliform Bacteria in a Closed-Lake Water
ACRA, A. Change in Quality of Thermal Groundwater	Creek, North-Central Texas, 1973 to 1981, W85-02042 2H	System, W85-01672 2H
From a Unique Resource in Lebanon, W85-01673 2F	ANGEHRN, M. Ultraviolet Disinfection of Water, W85-02020 5D	BAHLER, M.
ADAMS, D. D. Chemical Study of the Interstitial Water Dis-	ANSELL, C.	Suggestion for Year-Round Wastewater Utiliza- tion in the Forestry Industry (Vorschlag zur ganzjahrigen Abwasserverwertung in der
solved Organic Matter and Gases in Lake Erie, Cleveland Harbor, and Hamilton Harbour	Use of Models for Water Resources Manage- ment, Planning, and Policy, W85-02146 6A	Forstwirtschaft), W85-01971 5D
Bottom Sediments-Composition and Fluxes to Overlying Waters,	AREKAL, G. D.	BAIRD, W. F.
W85-01814 5B Flux of Reduced Chemical Constituents	Trace Metal Concentrations of the Waters of a South Indian River, W85-01751 5B	Design of Armour Systems for the Protection of Rubble Mound Breakwaters,
(Fe(2+), Mn(2+), NH4(+) and CH4) and Sediment Oxygen Demand in Lake Erie,	ARGO, D. G.	W85-01707 2J BAKER, J. R.
W85-02087 2H	Biological Fouling of Reverse Osmosis Mem- branes,	Limnology in Reservoirs on the Colorado River,
ADIGUZEL, R. I. Descriptive Decision Process Model for Hierar-	W85-01977 5D	W85-01812 2H
chical Management of Interconnected Reservoir	ARMSTRONG, J. L.	BAKKER, K.
Systems, W85-02147 4A	Association of Metal Tolerance with Multiple Antibiotic Resistance of Bacteria Isolated from Drinking Water,	Influence of Rainfall Characteristics on the Pol- lution Emission,
ADIN, A.	W85-02133 5F	W85-01697 2E
Contact Flocculation-Filtration of Humic Sub-	ARNELL V.	BALTES, A.
stances, W85-01722 5D	Rainfall Data For the Design of Detention Basins,	Corrosion and Protection of Pipes in Develop- ing Countries,
AGHA, F. Y. R.	W85-01695 2E	W85-01991 8A
Appropriate Technology to Improve Drinking	Review of Rainfall Data Application for Design	BANERJEE, S.
Water Quality, W85-02014 5F	and Analysis, W85-01677 2B	Solubility of Organic Mixtures in Water, W85-02109 5B
AHMAD, S.	ARONSON, D. A.	
Appropriate Technology to Improve Drinking Water Quality, W85-02014 5F	Geohydrology of the Meadowbrook Artificial- Recharge Project Site in East Meadow, Nassau	Toxicity of Organic Mixtures Saturated in Water to Daphnia magna. Effect of Compositional
	County, New York, W85-01774 2F	Changes, W85-01953 5C
AJAYI, O. Land Use, Runoff and Recharge on Selected	ARPAIA, M.	BARLOW, J. P.
Watersheds in the U.S. Virgin Islands, W85-01799 4C	Usefulness of Measuring the Corrosion Rates of Soils (Utilite des Mesures de Corrosivitie des	Partitioning of Phosphorus Between Particles and Water in a River Outflow,
ALEXANDER, M.	Sols), W85-01992 8G	W85-02075 2H
Effect of Substrate Concentration and Organic		BASLER, J. A.
and Inorganic Compounds on the Occurrence and Rate of Mineralization and Cometabolism, W85-02132 5B	ASKEW, G. R. Sediment Concentrations from Intensively Pre- pared Wetland Sites, W85-02112 4C	Instrumentation Used for Hydraulic Testing of Potential Water-Bearing Formations at the Waste Isolation Pilot Plant Site in Southeastern,
ALLAM, M. N. Irrigated Agricultural Expansion Planning in	ATKINSON, T. R.	New Mexico, W85-01827 7B
Developing Countries: Income Redistribution Objective.	Micro-Electronics in the Water Industry - A Review of Present and Probable Future Devel-	BAYLEY, S.
W85-02143 3F	opments,	Vegetation and Water Chemistry of Four Oligo-
Irrigated Agricultural Expansion Planning in	W85-02008 6A AUZIAS. F.	trophic Basin Mires in Northwestern Ontario, W85-01648 2H
Developing Countries: Investment Scheduling Incorporating Drainage Water Reuse, W85-02142 3F	Economising Water and Fighting against Wastage (Economie d'Eau et Lutte contre le Gaspil-	BAYS, L. R.
	lage),	Leakage Control,
Irrigated Agricultural Expansion Planning in Developing Countries: Resilient System Design,	W85-01996 6B AYERS, J. F.	W85-02016 3D BEDELL, G. W.
W85-02144 6A	Diagenesis and Pore-Space Evolution within	Analysis of Pollutant Enhanced Bacterial Blue-
ALLAN, J. W. Influence of Acid Precipitation on Stream Inver-	Recent and Pleistocene Carbonate Units of Orote Peninsula, Guam,	Green Algal Interrelationships Potentiating Sur- face Water Contamination by Noxious Blue-
tebrates, W85-01807 5C	W85-02027 2F	Green Algal Blooms,
	Feasibility Study of Developing Valley-Fill Aguifers for Village Water Supplies in Southern	W85-01803 5C
ALLEN, R. C. Competition Versus Optimal Control in Ground-	Guam, W85-02026 Aquiters for Village water Supplies in Southern 2F	BELL, J. F. MINES: A Model to Forecast Mine Wastewater
water Pumping when Demand is Nonlinear, W85-02141 4B	Hydrogeologic Investigation of Agana Swamp	Quality, W85-01750 5B
ANDERSEN, B. C.	Northern Guam, W85-02029 2F	
Logging Impacts and Some Mechanisms that		BELL, J. M. Effect of Various Hydrologic Parameters on the
Determine the Size of Spring and Summer Pop- ulations of Coho Salmon Fry (Oncorhynchus kisutch) in Carnation Creek, British Columbia,	BACHMAIER, J. Characteristics of Leachates from Hazardous	Quality of Stormwater Runoff from a West La- favette, Indiana Urban Watershed,
W85-01919 5C	Waste Landfills, W85-02118 5B	W85-01822 * 5B

* 5B

BENDL, R. E. Acute Toxicity of Kepone to Selected Freshwater Fishes,	BLECH, M. F. Study of Mutagenic Activity in Water in a Progressive Ozonation Unit (Etude du Caractere	on Phosphate Adsorption-Desorption by Stream Sediments, W85-01794 5B
W85-01846 3C	Mutagene de l'Eau dans une Filiere de Produc- tion a Ozonation Estagee),	BRAS, R. L.
BENNER, R. Relative Contributions of Bacteria and Fungi to	W85-01987 5F	Physically Based Flood Frequency Distribution, W85-02168 2E
Rates of Degradation of Lignocellulosic Detri- tus in Salt-Marsh Sediments, W85-02138 2L	BLEM, C. R. Annual Cycle of Kepone Residue and Lipid Content of the Estuarine Clam, Rangia cuneata,	BRAUN, A. M. Singlet Oxygen in Surface Waters - Part I: Fur-
BENNETT, C. S. Water Resources Data, South Carolina, Water	W85-01844 5C BLISS, L. C.	furyl Alcohol as a Trapping Agent, W85-01964 2K
Year 1982, W85-01937 2E	Phenology and Water Relations of Three Plant Life Forms in a Dry Tree-Line Meadow,	Singlet Oxygen in Surface Waters - Part II: Quantum Yields of Its Production by Some Nat-
BENNETT, G. F. Oil Spill Focuses Attention on the Problems of a Man-Made Recreational Lake,	W85-01892 2I BLOMQUIST, B. W.	ural Humic Materials as a Function of Wave- length, W85-01965 2K
W85-01650 5B	Organic and Inorganic Mercury Species in the Ft. Lewis Solvent Refined Coal Pilot Plant Water Treatment Process.	BRAVEN, J.
BENTLEY, C. B. Geohydrologic Data for Test Well USW G-4, Yucca Mountain Area, Nye County, Nevada,	W85-01798 5D	Initial Studies on the Use of High-Performance Liquid Chromatography for the Rapid Assess-
W85-02031 7C	BLUMBERG, M. S. Effect of Various Hydrologic Parameters on the Quality of Stormwater Runoff from a West La-	ment of Sewage Treatment Efficiency, W85-01721 5D
Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California, W85-01941 7C	fayette, Indiana Urban Watershed, W85-01822 5B	BREEN, C. M. Vertical Stratification in Sediments from a Young Oligotrophic South African Impound-
Data for Ground-Water Test Hole near Nico- laus, Central Valley Aquifer Project, California,	BONACCI, O. Rainfall as the Basis for Urban Runoff - Experience and Practice in Yugoslavia.	ment: Implications in Phosphorus Cycling, W85-02086 2H
W85-01929 7C	W85-01682 2B	BRESLAU, B. R. Evalution of Hollow Fiber Ultrafiltration as a
BETTANDORFF, J. M. Water Resources Data, Kentucky, Water Year 1982,	BONDE, G. J. Bacteria in Works and Mains from Ground Water Supplies,	Pretreatment for Reverse Osmosis Desalination of Seawater, W85-01830 3A
W85-01923 2E	W85-02001 5F	
BEVANS, H. E. Hydrologic Responses of Stream's to Mining of the Mulberry Coal Reserves in Eastern Kansas, W85-01782 2E	BOOTH, R. S. Major Institutional Arrangements Affecting Ground Water in New York State, W85-01802 6E	BRINKMANN, W. A. R. Association between Net Basin Supplies to Lake Superior and Supplies to the Lower Great Lakes,
BIERHALS, S.	BORLAND, J. P.	W85-01755 2H
Observations from the Test Operation of an Ion- exchange Facility for Nitrate Removal in Drink- ing-water Treatment (Erfahrungen aus dem Er- probengsbetrieb einer Ionenaustauscheranlage	Estimation of Natural Streamflow in the Jemez River at the Boundaries of Indian Lands, Central New Mexico,	BRINSFIELD, R. B. Blue Crab Processing Plant Effluent Treatment, W85-01741 5D
zur Nitratelimination in der Trinkwasseraufber- eitung),	W85-02048 2E BORMAN, R. G.	BROHI, AB. Rainfall Energy From Drop Size Data,
W85-01974 5F BIGGS, R. B.	Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg-	W85-01696 2B
Phosphorus Distribution in Sediments of the Delaware River Estuary, W85-01843	wick, and Weld Counties, Colorado, W85-01775 2F	BRONSON, A. Major Institutional Arrangements Affecting Ground Water in New York State,
HIGHAM, J. M.	BORTLESON, G. C. Occurrence, Quality, and Use of Ground Water in Orcas, San Juan, Lopez, and Shaw Islands,	W85-01802 6E
Effects of Phosphate Fertilizer Applications and Chemistry-Mineralogy of the Iron Oxide System on Phosphate Adsorption-Desorption by Stream	San Juan County, Washington, W85-02043 7C	BROOKS, J. M. Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico, W85-01963 5E
Sediments, W85-01794 5B	BOURBIGOT, M. M. Study of Mutagenic Activity in Water in a Pro-	BROWN, L.
BIRKELAND, C. Terrestrial Runoff as a Cause of Outbreaks of Acanthaster planci (Echinodermata: Asteroi-	gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc- tion a Ozonation Estagee), W85-01987 5F	Initial Studies on the Use of High-Performance Liquid Chromatography for the Rapid Assess- ment of Sewage Treatment Efficiency,
dea), W85-01893 SC	BOURGEOIS, H. S. JR.	W85-01721 5D BRUMMER, J.
BLACKEY, F. E. Water Resources Data, New Hampshire and Vermont, Water Year 1982,	Status of Reverse Osmosis vs. Ion Exchange for Petroleum/Petrochemical Utilities, W85-01853 5F	Rainfall Events as Paths of a Stochastic Process: Problems of Design Storm Analysis, W85-01684 2B
W85-01933 2E	BOUVEROT, M.	BRUNNER, C. W.
BLACKSTOCK, J. Environmental and Biochemical Investigation of Some Effects of Organic Pollution in Inner Os- lofford, Norway.	Remote Monitoring and Optimisation of Pump- ing at the Syndicat des Eaux of La Haute-Loue (Telesurveillance et Optimisation du Pompage du Syndicat des Eaux de La Haute-Loue),	Nonsteady-State-Biofilm Process for Advanced Organics Removal, W85-01658 5D
W85-01896 5C	W85-02005 5F	BRUTON, J. E.
BLAIR, R. E. JR. Pump Station Design: The Benefits of Computer Modeling, W85-01905 8C	BOYD, C. E. Effect of Treatment with a Commercial Bacterial Suspension on Water Quality in Channel Catfish Ponds.	Spectral Attenuation and Irradiance in the Lau- rentian Great Lakes, W85-01757 2H
BLAKE, T. J.	W85-01922 5F	BRUX, G. Concrete in Hydraulic Engineering for a Better
Stomatal Control of Water Use Efficiency in Poplar Clones and Hybrids, W85-01646 21	BRADY, K. S. Effects of Phosphate Fertilizer Applications and Chemistry-Mineralogy of the Iron Oxide System	Environment (Beton im Wasserbau fur bessere Umwelt), W85-01861 8F

BUCHANAN, T. Evaluation of Fisherman Benefits Stemming from Special Use Fishery Management Pro- grams,	CALLENDER, E. Benthic Phosphorus Regeneration in the Potomac River Estuary, W85-02088 2L	CHAU, A. S. Y. Chemical Derivatization Analysis of Pesticide Residues. VIII. Analysis of 15 Chlorophenols in Natural Water by In Situ Acetylation,
W85-01831 6B	CALOMIRIS, J. J.	W85-02113 5A
BUCHANAN, T. J. Highlights of the 1983 Federal-State Coopera- tive Water Resources Program, W85-01829 9D	Association of Metal Tolerance with Multiple Antibiotic Resistance of Bacteria Isolated from Drinking Water, W85-02133 5F	CHEN, JS. Elemental Composition of Suspended Particles From the Yellow and Yangtze Rivers, W85-01703
BUELL, G. R.	CAMERON, F. X.	W83-01703
Water Resources Data, Georgia, Water Year 1982, W85-01938 2E	International Cooperation and Acid Rain Pollu- tion: Establishing the Framework for Control, W85-01670 6E	CHEN, R. L. Role of Sediments in the Nitrogen Budget of Lower Green Bay, Lake Michigan, W85-01754 5B
BUKATA, R. P.	CAMPBELL, A. J.	W65-01/34 3B
Spectral Attenuation and Irradiance in the Lau- rentian Great Lakes, W85-01757 2H	Prediction of Peak Flows for Culvert Design on Small Watersheds in Oregon, W85-01820 4A	CHENCHAYYA, B. T. Depth-Duration Models of Short Time Increment Rainfall,
	CAMPBELL, J. E.	W85-01683 2B
BUNN, S. E. Seasonal Meromixis in Three Hypersaline Lakes on Rottnest Island, Western Australia,	Satellite-Tracked Current Drifters in Lake Michigan,	CHENG, A. HD. Darcy's Flow with Variable Permeability: A
W85-01645 2H	W85-01760 7B	Boundary Integral Solution,
BURMEISTER, I. L. Water Resources Data, Iowa, Water Year 1982, W85-01931 2E	CANNON, M. R. Potential Effects of Surface Coal Mining on the Hydrology of the Bloomfield Coal Tract,	W85-02165 2F CHENG, R. T.
	Dawson County, Eastern Montana,	Eulerian-Lagrangian Solution of the Convec-
BURROWS, R. L. Sediment Transport in the Tanana River near	W85-01791 2F	tion-Dispersion Equation in Natural Coordi- nates,
Fairbanks, Alaska, 1980-81,	CANOY, M. J.	W85-02162 1B
W85-01788 2J	Effects of Runoff from Undeveloped Versus Lightly Developed Watersheds on Tropical	CHILDERS, J. M.
Sediment Transport in the Tanana River near Fairbanks, Alaska, 1982, W85-01769 2J	Planktonic Ecosystem, W85-01810 5C	Reconnaissance of Surface Water Resources in the Togiak River Basin, Southwestern Alaska, 1980 and 1982,
BURTON, T. M.	CAPOBIANCO, J. A. Interaction Between Interstitial Water and Sedi-	W85-01777 2A
Influence of Acid Precipitation on Stream Inver- tebrates.	ment in Two Cores of Lac Leman, Switzerland, W85-02084 2H	CHOSHEN, E.
W85-01807 5C		Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine
BUSCHMAN, R. G.	CAPPENBERG, T. E. Carbon Flow Across the Sediment-Water Inter-	Dioxide,
Vertical Temperature Distribution in Lakes, W85-01651 2H	face in Lake Vechten, The Netherlands, W85-02066 2H	W85-01743 5A
	W 83-02000 2H	CHRZANOWSKI, T. H.
BUSENHART, H. Construction of the Alicura Hydroelectric Facility in Argentina (Der Bau der Wasserkraftanlage Alicura in Argentinien),	CAREY, J. H. Aquatic Leeches (Hirudinea) as Bioindicators of Organic Chemical Contaminants in Freshwater Ecosystems,	Transport of Dissolved Organic Carbon through a Major Creek of the North Inlet Ecosystem, W85-01766 2L
W85-01862 8A	W85-01958 5A	CLARK, R. M.
BUSKEY, E.	CARLSON, D. A.	Cost and Benefits of Drinking Water Treatment, W85-01649 5F
Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte- mora affinis (Copepoda),	Rapid BOD Measurement for Municipal Wastewater Samples using a Biofilm Electrode, W85-01739 5D	CLARK, W. J.
W85-01900 5C	CARPENTER, R.	Availability of Dissolved Oxygen in Interstitial Waters of a Sandy Creek,
BUSO, D. C.	Hydrocarbons in Washington Coastal Sedi-	W85-02103 2E
Potential for Acidification of Six Remote Ponds in the White Mountains of New Hamphire, W85-01834 5B	ments, W85-01915 5B	CLAUSNITZER, E. Results of Surface-water, Dyke, and Coastal In-
	CARTER, R. F.	spection - Ways Toward More Effective In- spection for the Future.
BYNOE, M. C. Physical and Geochemical Characteristics of Suspended Solids, Wilton Creek, Ontario,	Effects of the Drought of 1980-81 on Stream- flow and on Ground-water Levels in Georgia, W85-01783 2E	W85-01874 4A
W85-02056 2H	CASEY, H.	CLAYSHULTE, R. N. Diagenesis and Pore-Space Evolution within
CADENA, F. Removal of Volatile Organic Pollutants from	Influence of Within-Stream Disturbance on Dissolved Nutrient Levels During Spates,	Recent and Pleistocene Carbonate Units of Orote Peninsula, Guam,
Rapid Streams, W85-01738 5B	W85-02089 2E	W85-02027 2F
CALABRESE, E. J.	CASULLI, V. Eulerian-Lagrangian Solution of the Convec-	Feasibility Study of Developing Valley-Fill
Laboratory Assessment of the Toxicity of Urban Runoff on the Fathead Minnow (Pimephales	tion-Dispersion Equation in Natural Coordinates,	Aquifers for Village Water Supplies in Southern Guam,
promelas),	W85-02162 1B	
W85-02124 5C	CESARIO, A. L.	Hydrogeologic Investigation of Agana Swamp Northern Guam.
Lack of Nephrotoxicity in the Rat by Sodium Chlorite, a Possible Byproduct of Chlorine Di- oxide Disinfection in Drinking Water	Calibrating Water System Models, W85-01904 5F	W85-02029 2F
oxide Disinfection in Drinking Water, W85-02119 5F	CHARLTON, M. N.	CLEMENT, R. W. Improvement of Flood-Frequency Estimates for
CALKINS, D. J.	Oxygen Depletion in Central and Eastern Lake Erie: Relationship with Bacteria, Chlorophyll,	Selected Small Watersheds in Eastern Kansas
Ice Cover Melting in a Shallow River,	POC, and Morphometry,	using a Rainfall-Runoff Model,
W85-01713 2C	W85-01752 2H	W85-01786 2A

CLESCERI, L. S. Microbial Metabolism in Surface Sediments and its Role in the Immobilization of Phosphorus in Oligotrophic Lake Sediments,	COTTON, J. E. Water Resources Data, New Hampshire and Vermont, Water Year 1982, W85-01933 2E	DAVAUD, E. Basic Concepts and Associated Statistical Methodology in the Geochemical Study of Lake Sediments,
W85-02076 2J	COULTAS, C. L.	W85-02064 2J
CLITES, A. H.	Soils of Swamps in the Apalachicola, Florida,	DAVIS, J. O.
Satellite-Tracked Current Drifters in Lake	Estuary,	Calibrating Water System Models,
Michigan,	W85-01641 2L	W85-01904 5F
W85-01760 7B	CRAWFORD, R. L.	
COLE, C. A. Restoration of Failing On-Site Wastewater Dis-	Methane Production in Minnesota Peatlands, W85-02135 2L	DAVIS, N. Man-Made Structures on Marine Sediments: Effects on Adjacent Benthic Communities,
posal Systems Using Water Conservation,	CRIST, M. A.	W85-01895 6G
W85-01656 5D	Computer Program and Data Listing for Two-	
COLE, R. H. Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban	Dimensional Ground-Water Model for Laramie County, Wyoming, W85-01787 7C	DAVISON, W. Transport of Iron and Manganese in Relation to the Shapes of Their Concentration-Depth Pro-
Runoff Program,		files,
W85-01661 5A	CRUM, S. J. H.	W85-02090 2K
COLED D 4	Contribution of Leaching of Diazinon, Parath- ion, Tetrachorvinphos and Triazophos from	DAY, A. D.
COLER, R. A. Laboratory Assessment of the Toxicity of Urban	Glasshouse Soils to Their Concentrations in	Yield and Quality of Cotton Grown with
Runoff on the Fathead Minnow (Pimephales promelas),	Water Courses, W85-01961 5B	Wastewater, W85-01869 5D
W85-02124 5C	COLUMN D. D.	DANFON D P
COLLINS, M. A.	CRUZ, R. R. Annual Water-Resources Review, White Sands	DAYTON, P. K. Man-Made Structures on Marine Sediments: Ef-
Evaluation of Fisherman Benefits Stemming from Special Use Fishery Management Pro-	Missile Range, New Mexico, 1982, W85-01927 2E	fects on Adjacent Benthic Communities, W85-01895
grams,		***************************************
W85-01831 6B	CULVER, D. A. Trophic Ecology of Fish Rearing Ponds,	DE GROOT, A. J. Standardization of Methods of Analysis for
COLYER, P. J. Design Storm for a Tropical Location with Lim-	W85-01833 2H	Heavy Metals in Sediments,
ited Data.	CUMMINGS, T. R.	W85-02104 5A
W85-01678 2B	Estimates of Dissolved and Suspended Sub-	DE LA CLERGERIE, PH.
	stance Yield of Stream Basins in Michigan,	Comparison of Water Mains Cleaning Tech
CONNER, M. S.	W85-01942 5A	niques - The Experiment of Begles (Comparai
Comparison of the Carcinogenic Risks from Fish vs. Groundwater Contamination by Organic	CUNHA, H. J.	son des Techniques de Curage des Conduite
Compounds,	Reduction of Costs and Liability Risks in Elec-	d'Eau Potable - L'Experience de Begles),
W85-02110 5C	troplating Wastewater Treatment,	W85-01999 8A
COOK, W. G.	W85-01852 5D	DEAKYNE, C. W.
Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D	CUNNINGHAM, A. B. Mechanisms of Metal Adsorption from Aqueous Solutions by Waste Tyre Rubber,	Pilot Plant Demonstration of Biological Phos phorus Removal, W85-01657 5D
COOKE, J. B.	W85-01724 5D	
Progress in Rockfill Dams,	CONTROLLE CON	DEAN, J. R.
W85-01870 8A	CUNNINGHAM, G. B. Additional Tests on the Effect of Rainfall Inten-	Distribution and Concentrations of Naturally
COOKE, J. G.	sity on Storm Flow and Peak Flow from Wild-	Occurring Radionuclides in Sediments in a Ura nium Mining Area of Northern Saskatchewan
Water Quality of the Waiohewa Stream, Ro-	Land Basins,	Canada,
torua,	W85-02166 2E	W85-02083 51
W85-01634 5B	CURTISS, J. F.	DEPENDING IN
COPELAND, B. J.	Computerized Distribution Records- CADD	DEBERRY, D. W. Investigation of Photocatalytic Oxidation fo
Traveling Screens as Sampling Gear for Vertical	Paves the Way,	Wastewater Cleanup and Reuse,
Distribution Studies,	W85-01902 5F	W85-01813 5I
W85-01842 7B	DALBO, C. E.	
COPP, H.	Responses of Developing Estuarine Macro-	DECOURCELLE, P.
Mechanics of Mudflows,	benthic Communities to Drilling Muds,	Nice on the French Riviera - the Birthplace of Drinking Water Treatment with Ozone (Nice
W85-01816 8B	W85-01845 5C	sur la Riviera Française - Berceau du Traitemen
CORDERY, I.	DALGA, N.	de l'Eau par l'Ozone),
Time Patterns of Rainfall For Estimating Design	Study Cases of Operative Conditions of Munici-	W85-01988 51
Floods on a Frequency Basis,	pal Treatment by Lagooning (Etude des Condi-	DEIS, D. A.
W85-01687 2B	tions de Fonctionnement et d'Exploitation de	Chemical Study of the Interstitial Water Dis
CORNETT, R. J.	Quelques Cas Concrets de Traitement d'Eaux	solved Organic Matter and Gases in Lake Eric
Dependence of Hypolimnetic Oxygen Consump-	Residuaires Urbaines par Lagunage), W85-01976 5D	Cleveland Harbor, and Hamilton Harbou
tion on Ambient Oxygen Concentration: Fact or		Bottom SedimentsComposition and Fluxes to
Artifact, W85-02149 2H	DALY, E. L. JR.	Overlying Waters, W85-01814 51
W85-02149 2H	Heavy Metal Migration in Soil-Leachate Sys-	W85-01814 51
CORRAL, M. A. JR.	iems, W85-01868 5B	DELFINO, J. J.
Distribution of Selected Chemical Constituents		Determination of Aldicarb and its Derivatives i
in Water from the Floridan Aquifer, Southwest	DARDEN, D.	Groundwaters by High-Performance Liqui
Florida Water Management District, W85-01928 7C	Water-Level Maps of the Alluvial Aquifer,	Chromatography with UV Detection, W85-01748
	Northwestern Mississippi, April, 1982, W85-01926 7C	W85-01748 5/
COSKUNOGLU, O.		DELISTRATY, D. A.
Descriptive Decision Process Model for Hierar-	DASGUPTA, D.	Effects of the Herbicide Atrazine on Adenin
chical Management of Interconnected Reservoir Systems.	Heavy Metal Migration in Soil-Leachate Sys-	Nucleotide Levels in Zostera marina L. (Ee
W85-02147 4A	tems, W85-01868 5B	grass), W85-01888
***	30	25 01000

5C

DELLEUR, J. W. Effects of Urbanization on Frequencies of Over- flows and Pollutant Loadings from Storm Sewer Overflows: A Derived Distribution Approach, W85-02152 5B	DORISKI, T. P. Altitude of the Top of the Matawan Group- Magothy Formation, Suffolk Country, Long Island, New York, W85-02030 7B	DYCK, S. Ensuring a High Level of Effectiveness and Intensity of Agricultural and Water-Manage- ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi-
DEMAS, G.	DOSS, R.	tat der landwirtschaftlichen und wasserwirts- chaftlichen Produktion in Trinkwasser-Einzugs-
Erosion and Sedimentation Chronology of Three Watersheds in Maryland, W85-01835 2J	Effect of Clear-Cut Silviculture on Dissolved Ion Export and Water Yield in the Piedmont, W85-02171 5B	gebieten), W85-01883
DEPINTO, J. V.	Forests, Floods, and Erosion: A Watershed Ex-	DYRSSEN, D.
Algal-Availability of Particulate Phosphorus from Diffuse and Point Sources in the Lower	periment in the Southeastern Piedmont, W85-01705 2J	Simultaneous Determination of Partition Coeffi- cients and Acidity Constants of Chlorinated Phenols and Guaiacols by Gas Chromatography,
Great Lakes Basin, W85-02061 2K	DOWNEY, J. S. Machine-Readable Data Files from the Madison	W85-02115 5A
	Limestone and Northern Great Plains Regional	DZANTOB F V
DESBORDES, M. Areal Reduction Factors on Short Time and	Aquifer System Analysis Projects, Montana, Ne-	DZANTOR, E. K. Pesticides in Groundwater Beneath the Central
Space Intervals,	braska, North Dakota, South Dakota, and Wyo- ming,	Sand Plain of Wisconsin,
W85-01690 2B	W85-01790 7C	W85-02025 5B
DESPOTOVIC, J. Z.	DOWNING, G. G.	EASTHAM, A.
Statistical Methods of Storm Analysis, W85-01680 2B	Occurrence of the Asiatic Clam Corbicula flu- minea in the Maumee River and Western Lake	Stomatal Control of Water Use Efficiency in Poplar Clones and Hybrids, W85-01646 2I
DEWEY, R. J. Beach Fecal Coliforms,	Erie, W85-01753 5C	W85-01646 21
W85-01711 5B	DRISCOLL, C. T.	EDDS, J.
DIAMOND, S.	Short-Term Changes in the Base Neutralizing	Water Resources Data, Arkansas, Water Year 1982,
Use of Models for Water Resources Manage-	Capacity of an Acid Adirondack Lake, New York,	W85-01934 2E
ment, Planning, and Policy, W85-02146 6A	W85-01917 5B	EDWARD, D. H. D.
	DRUS, E.	Seasonal Meromixis in Three Hypersaline Lakes
DIAZ-GRANADOS, M. A. Physically Based Flood Frequency Distribution,	Suggestion for Year-Round Wastewater Utiliza-	on Rottnest Island, Western Australia, W85-01645 2H
W85-02168 2E	tion in the Forestry Industry (Vorschlag zur ganziahrigen Abwasserverwertung in der	W85-01645 2H
DICKERMAN, D. C.	Forstwirtschaft),	EICEMAN, G. A.
Aquifer Tests in the Stratified Drift, Chipuxet	W85-01971 5D	Removal of Volatile Organic Pollutants from Rapid Streams,
River Basin, Rhode Island, W85-02039 2F	DUBINSKI, B. J. Fluxes of Heavy Metals in Delaware River	W85-01738 5B
DICKS, S. E.	Freshwater Tidal Wetlands,	ELKINS, B. V.
Drought in Southeastern United States,	W85-01805 5B	Use of Artifical Wetlands to Remove Nitrogen
W85-01642 2B	DUERR, A. D. Hydrogeology and Water Quality of Six Landfill	Compounds from Wastewater, W85-01978 5D
DILLARD, L.	Sites in Hillsborough County, Florida,	
Hepatic Mixed-Function Oxidases in California Flatfishes are Increased in Contaminated Envi-	W85-01946 5B	ELLIOTT, J. G. Sediment Transport in the Lower Yampa River,
ronments and by Oil and PCB Ingestion,	DUINKER, J. C.	Northwestern Colorado,
W85-01894 5A	River Elbe: Processes Affecting the Behaviour of Metals and Organochlorines During Estuarine	W85-02045 2J
DILLION, P. J.	Mixing,	ELLIS, J. B.
Historical Changes in Anthropogenic Lead Fall- out in Southern Ontario, Canada,	W85-01836 5B	Hydrocarbon Accumulation in Freshwater Sedi- ments of an Urban Catchment,
W85-02063 5B	River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine	W85-02078 5B
Whole-Lake Lead Burdens in Sediments of	Mixing,	ELLIS, S. R.
Lakes in Southern Ontario, Canada, W85-02062 5B	W85-01837 5B	Calibration and Verification of a Rainfall-Runoff
	DUKE, H. R. Real Time Irrigation Scheduling via 'Reaching'	Model and a Runoff-Quality Model for Several Urban Basins in the Denver Metropolitan Area,
DIRICKX, J. Ozonation and Activated Carbon Filtration: a	Dynamic Programming,	Colorado,
Critical Evaluation,	W85-02155 3F	W85-02044 2A
W85-02019 5F	DUMONTEL, M.	ELLISON, G.
DISSANAYAKE, C. B. Distribution of Nitrates in the Potable Waters of	Remote Monitoring and Optimisation of Pump- ing at the Syndicat des Eaux of La Haute-Loue (Telesurveillance et Optimisation du Pompage	Automated Sensor Systems for Water Resource Pollution Warning and Treatment Process Con-
Sri Lanka, W85-02015 5B	du Syndicat des Eaux de La Haute-Loue),	trol, W85-02010 5F
Geochemistry of Well Water and Cardiovascu-	W85-02005 5F	
lar Diseases in Sri Lanka,	DUPONT, H. L. Detection of Enteric Viruses in Treated Drink-	ELSINGER, R. J. 226Ra and 228Ra in the Mixing Zones of the Pee
W85-01674 5C	ing Water,	Dee River-Winyah Bay, Yangtze River and
DOORNBOS, G.	W85-02136 5F	Delaware Bay Estuaries, W85-01912 2L
Changes in the Fish Fauna of the Former Gre- velingen Estuary, before and after the Closure in	DOTANO, M.	
1971,	W85-01990 5G	ELSNER, H. Observations from the Test Operation of an Ion-
W85-01765 6G	DWYER, F. J.	exchange Facility for Nitrate Removal in Drink-
DOREMUS, C. Microbial Metabolism in Surface Sediments and its Role in the Immobilization of Phosphorus in	Bioavailability of Pb and Zn from Mine Tailings as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in	ing-water Treatment (Erfahrungen aus dem Er- probengsbetrieb einer Ionenaustauscheranlage zur Nitratelimination in der Trinkwasseraufber- eitung),
Oligotrophic Lake Sediments, W85-02076 2J	Suckers (Pisces: Catostomidae), W85-01918 5A	W85-01974 5F

ENEY, A. B. State Laws Mandating Water Conservation, W85-01806 6E	Quelques Cas Concrets de Traitement d'Eaux Residuaires Urbaines par Lagunage), W85-01976 5D	FORTMANN, L. Fate of epsilon-Caprolactam in the Aquatic Environment,
ENGELBRECHT, R. S. Mixing Effects in UV Disinfection, W85-01659 5D	FIESSINGER, F. Potential Use of Enzymes as Catalysts in Drinking Water for the Oxidation of Taste Causing	W85-01956 5B FORTSON, J. C. Additional Tests on the Effect of Rainfall Inten-
ERKOLA, P. World's Longest Tunnel, W85-02003 8A	Substances, W85-02021 5F FILBY, R. H.	sity on Storm Flow and Peak Flow from Wild- Land Basins, W85-02166 2E
EVANS, R. D. Historical Changes in Anthropogenic Lead Fall- out in Southern Ontario, Canada,	Organic and Inorganic Mercury Species in the Ft. Lewis Solvent Refined Coal Pilot Plant Water Treatment Process, W85-01798 5D	FOSS, J. D. Erosion and Sedimentation Chronology of Three Watersheds in Maryland, W85-01835 2J
W85-02063 5B Whole-Lake Lead Burdens in Sediments of Lakes in Southern Ontario, Canada, W85-02062 5B	FILION-MYKLEBUST, C. Environmental and Biochemical Investigation of Some Effects of Organic Pollution in Inner Os- lofjord, Norway, W85-01896 5C	FOX, M. E. Aquatic Leeches (Hirudinea) as Bioindicators of Organic Chemical Contaminants in Freshwater Ecosystems,
FALKENMARK, M. New Ecological Approach to the Water Cycle: Ticket to the Future, W85-01704 6A	FINGER, S. E. Bioavailability of Pb and Zn from Mine Tailings as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in	W85-01958 5A FOXHOVEN, L. A. Water Resources Division Training Catalog, W85-02032 9B
FAN, L. S. Mechanism of Semifluidized Bed Bioreactor for Biological Phenol Degradation, W85-02106 5D	Suckers (Pisces: Catostomidae), W85-01918 5A FIORENTINO, M.	FRANKLIN, M. A. Magnitude and Frequency of Floods from Urban Streams in Leon County, Florida,
FANNING, D. Erosion and Sedimentation Chronology of Three Watersheds in Maryland.	Two-Component Extreme Value Distribution for Flood Frequency Analysis, W85-02151	W85-02047 4A FRANZBLAU, S. G. Effect of Noncoliforms on Coliform Detection
W85-01835 2J FARR, I. S. Influence of Within-Stream Disturbance on Dis-	FIRTH, C. F. JR. State-of-the-Art for Electronic Grade Ultrapure Water Manufacturing and Distribution, Part I, W85-01873 5F	in Potable Groundwater: Improved Recovery with an Anaerobic Membrane Filter Technique, W85-02140 5F
solved Nutrient Levels During Spates, W85-02089 2E FATHULLA, F.	FISCHER, E. E. Estimation of Natural Streamflow in the Jemez River at the Boundaries of Indian Lands, Central	FRASER, A. S. Mass Balance Models of Phosphorus in Sediments and Water,
Pesticides in Groundwater Beneath the Central Sand Plain of Wisconsin, W85-02025 5B	New Mexico, W85-02048 2E FTTZGERALD, M. J.	W85-02071 2J FRECKLETON, J. R. Ground Water in the Twenty-Nine Palms Indian
FAUP, G. M. Study Cases of Operative Conditions of Munici- pal Treatment by Lagooning (Etude des Condi-	Daily Water and Sediment Discharges from Selected Rivers of the Eastern United States: A Time-Series Modeling Approach, W85-01823	Reservation and Vicinity, San Bernardino County, California, W85-01779
tions de Fonctionnement et d'Exploitation de Quelques Cas Concrets de Traitement d'Eaux Residuaires Urbaines par Lagunage), W85-01976 5D	FLANNERY, M. S. Deepwater Sediments and Trophic Conditions in Florida Lakes,	FREDERICK, R. E. Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban Runoff Program,
FAVARGER, PY. Climatic and Anthropogenic Effects on the Sedimentation and Geochemistry of Lakes Bourget, Annecy and Leman, W85-02102 2H	W85-02099 FLEMMING, G. Calculation of Melt-water Discharge from the Snow Cover in Catchment Areas in the Mittel- gebirge Mountains (Berechnung der Schmelz-	W85-01661 5A FREITAG, D. Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/
FELTON, J. S. Hepatic Mixed-Function Oxidases in California Flatfishes are Increased in Contaminated Envi-	wasserabgabe aus der Schneedecke in Einzugs- gebieten des Mittelgebirges), W85-01972 2C	Water Partition Coefficient and Bioaccumula- tion of Organic Chemicals by Alga Chlorella, W85-01959 5B
ronments and by Oil and PCB Ingestion, W85-01894 5A FENDINGER, N. J.	FOELL, E. J. Kepone Concentration in Juvenile Anadromous Fishes, W85-01847 5B	FRENCH, J. J. Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California, W85-01941 7C
Chemical Study of the Interstitial Water Dis- solved Organic Matter and Gases in Lake Erie, Cleveland Harbor, and Hamilton Harbour Bottom Sediments-Composition and Fluxes to Overlying Waters.	FOGELMAN, R. P. Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California, W85-01941	Data for Ground-Water Test Hole near Nicolaus, Central Valley Aquifer Project, California, W85-01929 7C
W85-01814 5B FERNANDEZ, M. JR.	FONTAINE, J. Towards Total Automation of Water Distribu- tion (Vers l'Automatisation Integrale dans la	FRICKER, W. Origin of Nitrates in Groundwater of the Bunz Valley (Woher stammen die Nitrate im Grun-
Hydrogeology and Water Quality of Six Landfill Sites in Hillsborough County, Florida, W85-01946 5B	Distribution d'Eau), W85-02009 6A	wasser des Bunztales), W85-01856 5B FRIEDMAN, R.
Municipal Solid-Waste Disposal and Ground- Waster Quality in a Coastal Environment, West- Central Florida, W85-01789 5E	FORSTNER, U. Accumulative Phases for Heavy Metals in Limnic Sediments, W85-02077 5B	Use of Models for Water Resources Management, Planning, and Policy, W85-02146 6A
FERRY, M. Study Cases of Operative Conditions of Municipal Treatment by Lagooning (Etude des Conditions de Fonctionnement et d'Exploitation de	FORTI, A. Lack of Nephrotoxicity in the Rat by Sodium Chlorite, a Possible Byproduct of Chlorine Dioxide Disinfection in Drinking Water, W85-02119 5F	FRIND, E. O. Contaminant Transport in Fractured Porous Media: Analytical Solution for a Two-Member Decay Chain in a Single Fracture, W85-02170 5B

FRITTON, D. D. Restoration of Failing On-Site Wastewater Disposal Systems Using Water Conservation, W85-01656 5D	(Verbesserte Betriebskontrolle von Sedimenta- tionsanlagen durch Nutzung faseroptischer Sen- soren), W85-01882 5D	GOLTERMAN, H. L. Geochemistry of the Rhine and the Rhone and Human Impact (La Geochimie du Rhin et du Rhone et L'impact Humain),
FROEHLICH, H. A.	GERARD, R.	W85-02059 2H
Prediction of Peak Flows for Culvert Design on Small Watersheds in Oregon,	Microorganism Survival in an Ice-Covered River.	Loading Concentration Models for Phosphate in
W85-01820 4A	W85-01708 5B	Shallow Lakes, W85-02067 2H
FROELICH, P. N. JR. Modeling Estuarine Nutrient Geochemistry in a	GERBA, C. P. Detection of Enteric Viruses in Treated Drink-	GOOD, R. E.
Simple System, W85-01702 2L	ing Water, W85-02136 5F	Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands,
FUHRER, Z.	GERIKE, P.	W85-01805 5B
Contact Flocculation-Filtration of Humic Substances, W85-01722 5D	Biodegradability Testing of Poorly Water Soluble Compounds, W85-01957 5B	GOODRICH, J. A. Cost and Benefits of Drinking Water Treatment, W85-01649 5F
FUKASE, S. Behavior of Organically-Bound Iron in Seawater of Estuaries, W85-01913 2L	GERSBERG, R. M. Use of Artifical Wetlands to Remove Nitrogen Compounds from Wastewater, W85-01978 5D	GOODWIN, S. Conventional Water Process Costs Studied, W85-01706 5D
GADOURY, R. A. Water Resources Data, Massachusetts and Rhode Island, Water Year 1982, W85-01935 2E	GEYER, H. Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/ Water Partition Coefficient and Bioaccumula- tion of Organic Chemicals by Alga Chlorella,	GORDON, G. Lower Detection Limits Found for Chlorine Dioxide Contaminants, W85-01909 5F GOULD, J. P.
GAGGIANI, N. G. Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg- wick, and Weld Counties, Colorado, W85-01775 2F	W85-01959 5B GHASSEMI, M. Characteristics of Leachates from Hazardous Waste Landfills.	Formation of Stable Organic Chloramines During the Aqueous Chlorination of Cytosine and 5-Methylcytosine, W85-01726 5F
GAMBOLATI, G.	W85-02118 5B	Kinetics and Products of the Chlorination of
Groundwater Response under an Electronuclear Plant to a River Flood Wave Analyzed by a Nonlinear Finite Element Model.	GIBBONS, W. J. Water Quality of Lake Arlington on Village Creek, North-Central Texas, 1973 to 1981,	Caffeine in Aqueous Solution, W85-01727 5B
W85-02157 2F	W85-02042 2H	GOWDA, T. P. H.
GARCIA, J. Interaction Between Interstitial Water and Sediment in Two Cores of Lac Leman, Switzerland, W85-02084 2H	GIESY, J. P. Metal Speciation in Surface Waters of the Great Lakes Region, W85-01811 5A	Mixing Zone Studies in the Grand River Basin, W85-01710 5B GRANT, P. J. Drought Effect on High-Altitude Forests, Rua-
Manganese Cycle in Lac Leman, Switzerland: The Role of Metallogenium,	GILBERT, A. H. Economics of Acid Rain: An Invisible Hand of Control.	hine Range, North Island, New Zealand, W85-01886 2A
W85-02081 2H	W85-01666 5C	GREGORY, E. J.
GARG, S. K. Pressure Transient Analysis for Two-Phase Geothermal Wells: Some Numerical Results, W85-02163 2F	GILBERT, B. K. Highlights of the 1983 Federal-State Coopera- tive Water Resources Program, W85-01829 9D	Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase II, W85-01817 3F
GASSMAN, E.	GILES, I. A.	GRIMES, D. J.
Singlet Oxygen in Surface Waters - Part I: Fur- furyl Alcohol as a Trapping Agent, W85-01964 2K	Water Resources Data, Alabama, Water Year 1982, W85-01939 2E	Seasonal Study of a Freshwater Lake and Mi- gratory Waterfowl for Campylobacter Jejuni, W85-01639 5B
Singlet Oxygen in Surface Waters - Part II: Quantum Yields of Its Production by Some Nat- ural Humic Materials as a Function of Wave-	GIROUARD, G. G. Water Resources Data, Massachusetts and Rhode Island, Water Year 1982.	GRIMES, D. W. Developing the Resource Potential of a Shallow Water Table.
length, W85-01965 2K	W85-01935 2E	W85-01832 3B
GAULT, N. F. S. Spatial and Temporal Trends in Heavy Metal Concentrations in Mussels from Northern Ire- land Coastal Water,	GISSENDANNER, J. W. Water Resources Data, South Carolina, Water Year 1982, W85-01937 2E	GRINKER, J. R. Computer Controlled Operation of an Activated Sludge Plant, W85-01652 5D
W85-01901 5A GAVENS, A. Hydrocarbon Accumulation in Freshwater Sedi-	GISSER, M. Competition Versus Optimal Control in Ground- water Pumping when Demand is Nonlinear, W85-02141 4B	GROMBACH, P. Practical Introduction of the Remote Control Systems and Process Control Facilities,
ments of an Urban Catchment, W85-02078 5B	GLASE, M. S.	W85-02006 6A
GEIGER, C. O. Water Resources Data, Kansas Water Year 1982.	Partitioning of Phosphorus Between Particles and Water in a River Outflow, W85-02075 2H	GROOT, S. Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin- ame.
W85-01932 2E	GOLDMAN, C. R. Use of Artifical Wetlands to Remove Nitrogen	W85-01764 6G
GEIGER, E. L. Blue Crab Processing Plant Effluent Treatment, W85-01741 5D	Compounds from Wastewater, W85-01978 5D	GRUNEWALD, U. Ensuring a High Level of Effectiveness and
GEISENHEINER, A. Improved Operational Control of Sedimentation Facilities Through the Use of Fiberoptic Sensors	GOLDSTEIN, N. Waste Management Scenarios for Minnesota's Twin Cities, W85-01867 5E	Intensity of Agricultural and Water-Manage- ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi- tat der landwirtschaftlichen und wasserwirts-

chaftlichen Produktion in Trinkwasser-Einzugs-	Area Imprintation and Selective Sediment Modi-	HARTMANN, P.
gebieten), W85-01883 4D	fication, W85-01735 2J	Rebuilding of the Hydro-Electric Power Station of Spiez (Kraftwerk Spiez Erneuerung 1982-
GUNATILAKA, A. Phosphate Adsorption Kinetics of Resuspended	HANSEL, N. Forecasting of Water Level and Discharge of	1985), W85-01857 8A
Sediments in a Shallow Lake, Neusiedlersee,	the Elbe with the Aid of Fuzzy Modelling (Vor-	HARTUNG, G.
Austria, W85-02079 2H	hersage von Wasserstand und Durchfluss für die Elbe mit Hilfe einer unscharfen Modellierung), W85-01973 2E	Determination of Chlorine Dioxide and Chlorite in Drinking-Water (Bestimmung von Chlor-
GUPTA, R. C. Earth Foundation Treatment at Jebba Dam Site,		dioxid und Chlorit im Trinkwasser), W85-01664 5F
W85-01871 8D	HANSON, J. E. Breeding Mallard (Anas platyrhynchos) Habitat	
GURTZ, J.	Suitability Model,	HATFIELD, K. Evaluation of the Visibility Criterion of the Mas-
Calculation of Melt-water Discharge from the	W85-01792 6G	sachusetts Sanitary Code for Swimming in Natu-
Snow Cover in Catchment Areas in the Mittel-	HARKIN, J. M.	ral Waters,
gebirge Mountains (Berechnung der Schmelz- wasserabgabe aus der Schneedecke in Einzugs-	Pesticides in Groundwater Beneath the Central	W85-01800 6E
gebieten des Mittelgebirges),	Sand Plain of Wisconsin, W85-02025 5B	HATTENBACH, J.
W85-01972 2C	HARKNESS, R. E.	Friedrichroda Wastewater Treatment Facility - Results of an Experiment (Klaranlage Friedrich-
GUTTMAN-BASS, N.	Water Resources Data, North Dakota, Water	roda - Ergebnisse eines Experiments),
Simultaneous Concentration of Four Enterovir- uses from Tap, Waste, and Natural Waters,	Year 1982,	W85-01884 5D
W85-02137 5A	W85-01936 2E	HAVEN, D. S.
HAAG, W. R.	HARKNESS, W. E.	Uptake of Kepone from Sediment Suspensions
Singlet Oxygen in Surface Waters - Part I: Fur-	Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near	and Subsequent Loss by the Oyster Crassostrea virginia,
furyl Alcohol as a Trapping Agent, W85-01964 2K	the East Unit, Indiana Dunes National Lake- shore, Indiana, 1982,	W85-01897 5B
Singlet Oxygen in Surface Waters - Part II:	W85-01948 4A	HAVENS, J. S.
Quantum Yields of Its Production by Some Nat- ural Humic Materials as a Function of Wave-	HARPER, J. D.	Water-Level Changes in the High Plains Re- gional Aquifer, Northwestern Oklahoma, Prede-
length,	Acid Rain and Federal Common Law,	velopment to 1980,
W85-01965 2K	W85-01668 6E	W85-01771 2F
HAFFIELD, N. D.	HARPER, M. D.	HAYANO, S.
Water Resources Data, North Dakota, Water Year 1982.	Disposal of Household Wastewater in Soils of High Stone Content (1981-1983),	Material Balance Analysis for Fluoride Ions in
W85-01936 2E	W85-01815 5D	Experimental Waste Disposal Plant, W85-01732 5D
HAKANSON, L.	HARREMOES, P.	
Bottom Dynamics in Lakes,	Methods For Calculation of Annual and Ex-	HAYES, R. D. Water Resources Data, South Carolina, Water
W85-02054 2J	treme Overflow Events From Combined Sewer Systems,	Year 1982,
HALDORSEN, O.	W85-01699 2E	W85-01937 2E
Drinking Water in Developing Countries - The Minimum Treatment Philosophy. A Case Study,	Review of Rainfall Data Application for Design	HEALY, R. P.
W85-02018 3B	and Analysis,	Preliminary Findings of the Priority Pollutant Monitoring Project of the Nationwide Urban
HALE, T. W.	W85-01677 2B	Runoff Program,
Water Resources Data, Georgia, Water Year	Staged Approach to Application of Rainfall	W85-01661 5A
1982, W85-01938 2E	Data to Urban Runoff Calculations, W85-01694 2E	HEEPE, R.
HALL, F.		Development of the Schwarzheide Chemical
Tidal and Seasonal Variations of Sulfate Ion in a	HARRIS, G. P. Phytoplankton Population Dynamics of a Small	Synthesis Works in the Field of Wastewater and By-product Treatment (Entwickling des VEB
New Jersey Marsh System, W85-01848 5B	Reservoir: Effect of Intermittent Mixing on Phy-	Synthesewerk Schwarzheide auf dem Gebiet der
	toplankton Succession and the Growth of Blue- green Algae.	Abwasser- und Abproduktbehandlung), W85-01881 5D
HALL, K. R. Design of Armour Systems for the Protection of	W85-01916 2H	17.0
Rubble Mound Breakwaters,	HARRIS, R. U.	HEERMANN, D. F.
W85-01707 2J	Computer Modeling in Water System Planning	Real Time Irrigation Scheduling via 'Reaching' Dynamic Programming,
HAMILTON, H. R.	and Design, W85-01906 5F	W85-02155 3F
Spatial Heterogeneity in Whole Lake Sediments - Towards a Loading Estimate,		HEILMANN, K.
W85-02073 2H	HARROLD, P. E. Sediment Transport in the Tanana River near	Reduction of the Use of Materials with the Aid
HAMMER, U. T.	Fairbanks, Alaska, 1980-81,	of Science and Technology at the Hydrotechno- logy and Water-Management-Planning Combine
Dynamics and Mechanisms of Arsenite Oxida-	W85-01788 2J	(Senkung des Produktionsverbrauchs mit Hilfe
tion by Freshwater Lake Sediments, W85-02080 5B	Sediment Transport in the Tanana River near	von Wissenschaft und Technik im VEB Kom-
	Fairbanks, Alaska, 1982,	binat Wassertechnik un Projektierung Wasser- wirtschaft),
HAMMERSCHLAG, R. S. Toxicity of Chlorine to a Common Vascular	W85-01769 2J	W85-01968 5D
Aquatic Plant,	HART, R. J. Flood-Frequency Estimates for Five Gaged	HEITKAMP, M. A.
W85-01731 5C	Basins in Wichita, Kansas,	Impact of an Oil Field Effluent on Microbial
HANCOCK, G. D.	W85-01949 2A	Activities in a Wyoming River,
Microwave Measurements of Moisture Distribu- tions in the Upper Soil Profile,	HARTEMANN, P.	W85-01640 . 5C
W85-02160 2G	Study of Mutagenic Activity in Water in a Pro-	HELDER, W.
HANER, B. E.	gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc-	One-Dimensional Mixing and Flushing Model of the Ems-Dollard Estuary: Calculation of Time
Santa Ana River: An Example of a Sandy Braid-	tion a Ozonation Estagee),	Scales at Different River Discharges,
ed Floodplain System Showing Sediment Source	W85-01987 5F	W85-01838 2L

HEMENWAY, D. R.	HILLEBRAND, M. T. J.	HOLLORAN, M.
Microbial Contamination of Potable Water in	River Elbe: Processes Affecting the Behaviour	Model for Instream Regulation of Radioisotopes
Distribution Systems, W85-01796 5F	of Metals and Organochlorines During Estuarine	and Heavy Metals in Riverine Waters Subjected to a Uranium Mill Discharge,
	Mixing, W85-01836 5B	W85-02068 5B
HEMMING, J. Method for Total Organic Chlorine Determina-		
tion in Bleach Plant Recipient Waters,	River Weser Processes Affecting the Behaviour	ногмвом, в.
W85-01962 5A	of Metals and Organochlorines during Estuarine Mixing,	Method for Total Organic Chlorine Determina-
HENDERSON, D. W.	W85-01837 5B	tion in Bleach Plant Recipient Waters, W85-01962 5A
Developing the Resource Potential of a Shallow		W 03-01702
Water Table,	HINNEBUSCH, B. J. Effect of Noncoliforms on Coliform Detection	HOLMES, W. F.
W85-01832 3B	in Potable Groundwater: Improved Recovery	Three-Dimensional Digital-Computer Model of
HENDERSON, S. E.	with an Anaerobic Membrane Filter Technique,	the Principal Ground-Water Reservoir of the Sevier Desert, Utah,
Hydrology of Lake Padgett, Saxon Lake, and	W85-02140 5F	W85-01925 7C
Adjacent Area, Pasco County, Florida, W85-01826 7C	HIRSCH, M. S.	
W85-01826 7C	Disposal of Household Wastewater in Soils of	HONABACH, D. R.
HENRY, D. D.	High Stone Content (1981-1983),	Tort Recovery of Acid Rain Damages in the United States - Observations on Plaintiff's Prima
Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake	W85-01815 5D	Facie Case,
Waramaug, Connecticut,	но, к. с.	W85-01667 6E
W85-02093 2H	Heavy Metals in Ulva lactuca Collected within	HOOF P. P.
HENRY, J. A.	Tolo Harbour, An Almost Landlocked Sea,	HOOK, D. D. Waterlogging Tolerance of Lowland Tree Spe-
Drought in Southeastern United States,	W85-01762 5B	cies of the South,
W85-01642 2B	HOARE, R. A.	W85-02111 2I
HERLONG, H. E.	Nitrogen and Phosphorus in the Ngongotaha	HORE D. D.
Water Resources Data, South Carolina, Water	Stream,	HOPE, B. B.
Year 1982,	W85-01635 5B	Measurement of Concrete Permeability, W85-01714 8F
W85-01937 2E	HODSON, R. E.	W03-01714
HERRMANN, R.	Relative Contributions of Bacteria and Fungi to	HORDIJK, K. A.
Behaviour of Polycyclic Aromatic Hydrocar-	Rates of Degradation of Lignocellulosic Detri-	Carbon Flow Across the Sediment-Water Inter-
bons in the Exe Estuary, Devon, W85-01841 5B	tus in Salt-Marsh Sediments, W85-02138 2L	face in Lake Vechten, The Netherlands, W85-02066 2H
		W 63-02000 251
HERSHFIELD, D. M. Some Statistical Properties of Short-Duration	HOEKSEMA, R. J.	HORKAI, A.
Rainfall.	Application of the Geostatistical Approach to the Inverse Problem in Two-Dimensional	Wastewater Purification as Related to the Study
W85-01681 2B	Groundwater Modeling,	of a River System (Abwasserreiningung in Ver- bindung mit der Untersuchung eines Flusssys-
HERSHNER, C.	W85-02169 2F	tems),
Effects of the Herbicide Atrazine on Adenine	MOMBALL W. T.	W85-01885 5D
Nucleotide Levels in Zostera marina L. (Eel-	HOFFMAN, E. J. Urban Runoff as a Source of Polycyclic Aro-	
grass),	matic Hydrocarbons to Coastal Waters,	HORNBECK, J. W. Potential for Acidification of Six Remote Ponds
W85-01888 5C	W85-02108 5B	in the White Mountains of New Hamphire,
HESS, G. G.	TIOTER AND A	W85-01834 5B
Chemical Study of the Interstitial Water Dis- solved Organic Matter and Gases in Lake Erie,	HOFFMANN, A. Improved Operational Control of Sedimentation	
Cleveland Harbor, and Hamilton Harbour	Facilities Through the Use of Fiberoptic Sensors	HORNBERGER, G. M.
Bottom SedimentsComposition and Fluxes to	(Verbesserte Betriebskontrolle von Sedimenta-	Modeling Algal Behaviour in the River Thames, W85-01720 5G
Overlying Waters,	tionsanlagen durch Nutzung faseroptischer Sen-	W65-01720
W85-01814 5B	soren), W85-01882 5D	HORVATH, J.
HEWES, K. A.	W 63-01662	Synthetic Design Storm and its Relation to In-
Dehalogenation of Three Chlorinated Hydrocar-	HOFFMANN, L.	tensity-Duration Frequency Curves, W85-01679 2B
bons: Amine-Assisted Versus Metal-Chelate As- sisted,	Results and Experience of the Greiz Water-	1103-01079
W85-02121 5F	Supply District in the Field of Rational Water Use (Ergebnisse und Erfahrungen des Versor-	HOTCHKISS, W. R.
	gungsbereichs Greiz bei der rationellen Wasser-	Water Resources Division Training Catalog,
HEWLETT, J. D. Additional Tests on the Effect of Rainfall Inten-	verwendung),	W85-02032 9B
sity on Storm Flow and Peak Flow from Wild-	W85-01880 3D	HOWITT, R. E.
Land Basins,	HOIGNE, J.	Managing Water Scarcity: An Evaluation of In-
W85-02166 2E	Singlet Oxygen in Surface Waters - Part I: Fur-	terregional Transfers, W85-02145 6F
Effect of Clear-Cut Silviculture on Dissolved	furyl Alcohol as a Trapping Agent,	
Ion Export and Water Yield in the Piedmont,	W85-01964 2K	HUANG, P. M.
W85-02171 5B	Singlet Oxygen in Surface Waters - Part II:	
Forests, Floods, and Erosion: A Watershed Ex-	Quantum Yields of Its Production by Some Nat-	
periment in the Southeastern Piedmont, W85-01705 2J	ural Humic Materials as a Function of Wave-	W85-02080 5B
W85-01705 2J	length, W85-01965 2K	HUBER, D.
HIELTJES, A. H. M.	17.70	Ultraviolet Disinfection of Secondary Effluent,
Dynamic Phosphate Budget Model for a Eutro- phic Lake,	HOKE, S. H.	W85-01654 5D
W85-02072 2H	Microbial Degradation of 2,4,6-Trichloroaniline in Aquatic Samples and Laboratory Enrichment	
	Cultures,	Behaviour of Polycyclic Aromatic Hydrocar-
HIGGINS, J. D. Mechanics of Mudflows,	W85-02120 5B	bons in the Exe Estuary, Devon,
W85-01816 8B	HOLLEDMAN W.D.	W85-01841 5B
	HOLLERMAN, W. D. Effect of Treatment with a Commercial Bacte-	HUGGETT, R. J.
HILL, G. A. Seasonal Study of a Freshwater Lake and Mi-		Kepone Concentration in Juvenile Anadromous
gratory Waterfowl for Campylobacter Jejuni,	Catfish Ponds,	Fishes,
W85-01639 5B	W85-01922 5F	W85-01847 5B

HUGHES, D. E.	JACKSON, L. E. Phenology and Water Relations of Three Plant	Review of Rainfall Data Application for Design and Analysis,
Adsorption of Copper, Lead and Cobalt by Activated Carbon, W85-01717 5D	Life Forms in a Dry Tree-Line Meadow, W85-01892 2I	W85-01677 2B
HUGHES, W. D. Training Programmes in Federal Systems of	JACKSON, T. A. Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal	Staged Approach to Application of Rainfall Data to Urban Runoff Calculations, W85-01694 2E
Government, W85-01989 6F	and Regional Variations, W85-02091 5B	JOHNSON, B. T.
HUSBAND, F. M. Mechanisms of Metal Adsorption from Aqueous Solutions by Waste Tyre Rubber, W85-01724 5D	JACOBY, J. M. Occurrence, Quality, and Use of Ground Water in Orcas, San Juan, Lopez, and Shaw Islands,	Impact of an Oil Field Effluent on Microbial Activities in a Wyoming River, W85-01640 5C
HUTCHINS, S. R.	San Juan County, Washington, W85-02043 7C	JOHNSTON, W. H. Floods of August 7-8, 1979, in Chautauqua
Fate of Trace Organics During Rapid Infiltra- tion of Primary Wastewater at Fort Devens, Massachusetts, W85-01730 5D	JACQUET, JM. Interaction Between Interstitial Water and Sediment in Two Cores of Lac Leman, Switzerland, W85-02084 2H	County, New York, with Hydraulic Analysis of Canadaway Creek in the Village of Fredonia, W85-02051 2E
		JONES, F. A.
HUTCHINSON, C. B. Hydrogeology of Well-Field Areas near Tampa, Florida, Phase 2—Development and Documenta- tion of a Quasi-Three-Dimensional Finite-Differ-	JAHN, S. A. A. First Experiences with a Women-Specific Project for the Water Decade, W85-02004 5F	Pesticides in Groundwater Beneath the Central Sand Plain of Wisconsin, W85-02025 5B
ence Model for Simulation of Steady-State Ground-Water Flow, W85-02052 2F	JAMES, W. Evolving Data Processing Environment For	JONES, J. G. Automated Water Laboratory - What Benefit to
IBRAHIM, J.	Computational Hydraulics Systems, W85-01709 7C	the Consumer, W85-02011 7B
Chlorine as an Algicide in a Conventional Water	JANSSENS, J. G.	JONES, J. N.
Treatment Plant, W85-01749 5F	Ozonation and Activated Carbon Filtration: a Critical Evaluation,	Matara Water Supply Project in Sri Lanka,
IGARASHI, K.	W85-02019 5F	W85-02013 5F
Behavior of Organically-Bound Iron in Seawater of Estuaries.	JAQUET, J. M. Basic Concepts and Associated Statistical Meth-	JONES, P. D.
W85-01913 2L	odology in the Geochemical Study of Lake	Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal
IKEDA, Y.	Sediments, W85-02064 2J	and Regional Variations,
Lower Detection Limits Found for Chlorine Dioxide Contaminants,	Manganese Cycle in Lac Leman, Switzerland:	W85-02091 5B
W85-01909 5F	The Role of Metallogenium, W85-02081 2H	JONES, R. A. Fishable Waters Everywhere: An Appropriate
ILOABACHIE, B. C. Earth Foundation Treatment at Jebba Dam Site,	JARDIM, W. F.	Goal, W85-01850 6B
W85-01871 8D INDERMAUR, W.	Study of the Copper-Complexing Compounds Released by Some Species of Cyanobacteria, W85-01725 5B	JONKHEER, G. J.
Tasks of the Dam Keeper (Les Taches du Gar-	JENSEN, M.	Carbon Flow Across the Sediment-Water Inter- face in Lake Vechten, The Netherlands,
dien de Barrage), W85-01859 4A	Methods For Calculation of Annual and Ex- treme Overflow Events From Combined Sewer	W85-02066 · 2H
IRELAND, J. C. Cost and Benefits of Drinking Water Treatment,	Systems, W85-01699 2E	JUNKINS, B. Effect of Chlorination on Antibiotic Resistance
W85-01649 5F	Review of Rainfall Data Application for Design	Profiles of Sewage-Related Bacteria, W85-02139 5D
IRWIN, J. Predominant Headwater Inflow and its Control	and Analysis, W85-01677 2B	KAHWA, I. A.
of Lake-River Interactions in Lake Wakatipu, W85-01638 2H	Staged Approach to Application of Rainfall Data to Urban Runoff Calculations,	Heavy Metals in the Lower Mississippi River, W85-01744. 5B
Water Temperature and Turbidity in Glacially	W85-01694 2E	KALLMANN, R.
Fed Lake Tekspo, W85-01637 2H ISELY, R. B.	JEPPESEN, E. Diurnal Variation in the Oxygen Uptake of River Sediments in Vitro by Use of Continuous	Asynchronous Generator; An Alternative to the Synchronous Generator for Small Hydroelectric Power Stations with Output up to 20,000 kW
Development and Field Testing of a Methodolo- gy for Assessing Commmunity Readiness for	Flow-Through Systems, W85-02069 2E	(Der Asynchrongenerator; Eine Alternative zum Synchrongenerator für kleine Wasserkraftanla-
Self-Help in the Installation, Maintenance and Repair of Water Supply and Sanitation Facili- ties,	JEROME, J. H. Spectral Attenuation and Irradiance in the Laurentian Great Lakes,	gen mit einer Leistung bis 20000 kW), W85-01858 8C
W85-01980 7C	W85-01757 2H	KALLSEN, C. E.
IVEY, J. M. Responses of Developing Estuarine Macro- benthic Communities to Drilling Muds,	JEWSON, D. H. Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh,	Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase II,
W85-01845 5C	Northern Ireland, W85-02085 2H	W85-01817 3F
IWASAKI, T.	JIMENEZ-PEREZ, R.	KANGA, A. R. Current Water Treatment Practices in Western
Material Balance Analysis for Fluoride Ions in Experimental Waste Disposal Plant, W85-01732 5D	Seismic Design Criteria for Buried Water Pipe- line in Puerto Rico, W85-01821 8A	India - Case Studies of Two Metropolitan Cities, Bombay and Ahmedabad,
JACKSON, F.		W85-02024 5F
Evaluation of Electrode Methods for Determin- ing Total Residual Chlorine in Various Water Matrices,	JOHANSEN, N. B. Methods For Calculation of Annual and Ex- treme Overflow Events From Combined Sewer Systems,	KARAHAGOPIAN, Y. Change in Quality of Thermal Groundwater From a Unique Resource in Lebanon,
W85-02123 7B	W85-01699 2E	W85-01673 2F

١

KARLANDER, E. P. Effects of the Herbicide Atrazine on an Oyster- Food Organism, W85-01808 5C	(Impact d'une Pollution d'Origine Urbaine sur les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty- picus)),	KLEIN, W. Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi- ty and Physico-chemical Conditions in Compart-
KARLINGER, M. R.	W85-01898 5C	ments of a Freshwater Pond, W85-01967 5C
Daily Water and Sediment Discharges from Se- lected Rivers of the Eastern United States: A Time-Series Modeling Approach, W85-01823 2J	KERNODLE, D. R. Reconnaissance of Surface Water Resources in the Togiak River Basin, Southwestern Alaska, 1980 and 1982,	KLOMP, R. Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-
KARPINSKI, M. Investigation of Photocatalytic Oxidation for	W85-01777 2A KESSAVO RAO, A. V. R.	ame, W85-01764 6G
Wastewater Cleanup and Reuse, W85-01813 5D	Water Balance and Crops in Karnataka, W85-02127 2I	KNOX, S. Statistical Analysis of Estuarine Profiles: II Application to Arsenic in the Tamar Estuary (S.W.
KARR, P. R. Effect of Low Dissolved Oxygen Concentration on Effluent Turbidity,	KESWICK, B. H. Detection of Enteric Viruses in Treated Drinking Water,	England), W85-01914 5B
W85-01653 5D KATZ, B. G.	W85-02136 5F KEULDER, P. C.	KODUKULA, P. S. Metals Distributions in Activated Sludge Sys-
Geohydrology of the Meadowbrook Artificial- Recharge Project Site in East Meadow, Nassau County, New York,	Particle Size Distribution and Chemical Parameters of the Sediments of a Shallow Turbid Impoundment,	tems, W85-01737 5D
W85-01774 2F	W85-02082 2H	KOH, E. S. Microcomputer Programs for Designing Water
KATZ, W. E. State-of-the-Art of the Electrodialysis Reversal	KHAN, A. M. Influence of Physico-Chemical Factors on the Coliform Bacteria in a Closed-Lake Water	Systems, W85-01903 8A
(EDR) Process, W85-01851 5D	System, W85-01672 2H	KOHONEN, T. New Instrumentation in Automatic Water Qual-
KAUFMAN, S. Epilimnetic Nutrient Loading by Metalimnetic	KIERSTEIN, R. A.	ity Monitoring, W85-02007 5G
Erosion and Resultant Algal Responses in Lake Waramaug, Connecticut, W85-02093 2H	True Location and Orientation of Fractures Logged with the Acoustic Televiewer (Includ- ing Programs to Correct Fracture Orientation), W85-01780 2F	KOIVO, L. Zinc in Water and Sediments of Two Finnish Lakes,
KAUFMANN, K. Weinzodl Power Station on the Mur (Das	KILANI, J. S.	W85-02065 5B
Kraftwerk Weizodl an der Mur), W85-01860 8A	Effects of Baffles on the Performance of Model Waste Stabilization Ponds, W85-01719 5D	KOLTERMANN, C. R. LP Embedded Simulation Model for Conjunctive Use Management Optimization,
KAUL, L. W. Modeling Estuarine Nutrient Geochemistry in a Simple System,	KILCULLEN, B. M. Evalution of Hollow Fiber Ultrafiltration as a	W85-01801 4B KOOL, H, J.
W85-01702 2L	Pretreatment for Reverse Osmosis Desalination of Seawater,	Formation and Removal of Mutagenic Activity During Drinking Water Preparation,
KEAENEY, M. S. Recent Vertical Accretion Rates at Blackwater	W85-01830 3A	W85-01728 5F
Wildlife Refuge, W85-01809 2L	KINARD, J. T. Evaluation of Electrode Methods for Determining Total Residual Chlorine in Various Water	KORTE, F. Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi-
KEENEY, D. R. Role of Sediments in the Nitrogen Budget of Lower Green Bay, Lake Michigan,	Matrices, W85-02123 7B	ty and Physico-chemical Conditions in Compart- ments of a Freshwater Pond,
W85-01754 5B	KING, W. A. Morphology and Recent Sediments of the	W85-01967 5C KORTMANN, R. W.
KELLEY, L. M. Effect of Noncoliforms on Coliform Detection in Potable Groundwater: Improved Recovery	Lower Anastomosing Reaches of the Attawapis- kat River, James Bay, Ontario, Canada, W85-01734 2J	Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake Waramaug, Connecticut,
with an Anaerobic Membrane Filter Technique, W85-02140 5F	KIRCHER, J. E. Sediment Transport in the Lower Yampa River,	W85-02093 2H
KEMP, N. J. Vertical Temperature Distribution in Lakes,	Northwestern Colorado, W85-02045 2J	KOSCHMIEDER, U. Results and Experience of the Greiz Water- Supply District in the Field of Rational Water
W85-01651 2H KENNEDY, E. J.	KITANIDIS, P. K. Application of the Geostatistical Approach to	Use (Ergebnisse und Erfahrungen des Versor- gungsbereichs Greiz bei der rationellen Wasser-
Computation of Continuous Streamflow Records,	the Inverse Problem in Two-Dimensional Groundwater Modeling,	verwendung), W85-01880 3D
W85-02053 2E KENNICUTT, M. C. II	W85-02169 2F KLAPWIJK, A.	KOSZALKA, E. J. Altitude of the Top of the Matawan Group-
Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico, W85-01963 5E	Experimental Measurement of Sediment Nitrifi- cation and Denitrification in Hamilton Harbour, Canada,	Magothy Formation, Suffolk Country, Long Island, New York, W85-02030 7B
KENNY, J. F.	W85-02070 2H	KREIS, R. G. JR.
Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined Areas of Southeastern Kansas,	KLAPWIJK, S. P. Available Phosphorus in Lake Sediments in the Netherlands, NYS COOC.	Influence of the St. Marys River Plume on Northern Lake Huron Phytoplankton Assem- blages, W85-01756 2H
W85-01947 5B	W85-02092 2H KLAUSING, R. L.	KRICHTEN, D. J.
KERAMBRUN, P. Impact of Domestic Sewage Pollution on Enzy- matic Activities of Two Planktonic Copepods (Acartia clausi and Centropages typicus)	Basin, New Mexico (1982-83), W85-02034 RADIAN STREET, R. L. REAL	Pilot Plant Demonstration of Biological Phosphorus Removal, W85-01657 5D

KROON, J. M. W. Available Phosphorus in Lake Sediments in the Netherlands,	LAMPARSKI, L. I. Determination of 2,3,7,8-Tetrachlorodibenzo-p- Dioxin in Treated Wastewater,	LENTZ, J. J. Runoff from Utility Waste Landfill to be Recycled from Detention Basin to Scrubber Make-
W85-02092 2H	W85-01729 5A	Up,
KROUTIL, W. F.	LANGSTON, W. J.	W85-01849 5D
Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains, W85-01952 3F	Statistical Analysis of Estuarine Profiles: II Application to Arsenic in the Tamar Estuary (S.W. England).	LETTY, D. F. Water Resources Data, Massachusetts and
	W85-01914 5B	Rhode Island, Water Year 1982,
KRULIKAS, R. K.	TARCEN Y R	W85-01935 2E
Altitude of the Top of the Matawan Group- Magothy Formation, Suffolk Country, Long Island, New York, W85-02030 7B	LARGEN, J. B. Drainage Basins in Duval County, Florida, W85-02046 7C	LEWIS, T. Accumulation of the Trace Elements Lead and Zinc by Asellus communis at Three Different
PHIPPHIPP A	LARKIN, P. A. Commentary on Environmental Impact Assess-	pH Levels,
KUETHER, A. Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake	ment for Large Projects Affecting Lakes and Streams,	W85-01795 5B LEYTHAM, K. M.
Waramaug, Connecticut, W85-02093 2H	W85-01920 6G	Maximum Likelihood Estimates for the Param-
W 63-02093	LATIMER, J. S.	eters of Mixture Distributions,
KUHLES, H. Friedrichroda Wastewater Treatment Facility -	Urban Runoff as a Source of Polycyclic Aromatic Hydrocarbons to Coastal Waters,	W85-02156 2E LI, YH.
Results of an Experiment (Klaranlage Friedrich-	W85-02108 5B	Elemental Composition of Suspended Particles
roda - Ergebnisse eines Experiments), W85-01884 5D	LAUWEN, J. P. M. Carbon Flow Across the Sediment-Water Inter-	From the Yellow and Yangtze Rivers, W85-01703 2J
KUNKLE, G. R. Oil Spill Focuses Attention on the Problems of a	face in Lake Vechten, The Netherlands, W85-02066 2H	LIAW, W. K.
Man-Made Recreational Lake,	LAWLER, D. F.	Dynamics and Mechanisms of Arsenite Oxida-
W85-01650 5B	Flocculation Model Testing: Particle Sizes in a	tion by Freshwater Lake Sediments, W85-02080 5B
KURASHINA, H.	Softening Plant,	W85-02080 5B
Comparision of Water Catchment and Storage Systems in Two Micronesian Atoll Communi-	W85-01908 5F	LICK, W.
ties: Laura and Nama,	LAY, J. P.	Entrainment, Deposition, and Transport of Fine- Grained Sediments in Lakes.
W85-02028 6D	Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi-	W85-02055 2J
KUSHNER, D. J.	ty and Physico-chemical Conditions in Compart-	LIDDICOAT, M. I.
Effect of Chlorination on Antibiotic Resistance Profiles of Sewage-Related Bacteria,	ments of a Freshwater Pond, W85-01967 5C	Statistical Analysis of Estuarine Profiles: II Ap-
W85-02139 5D		plication to Arsenic in the Tamar Estuary (S.W.
KWOK, T. T.	LEACH, S. D. Projected Public Supply and Rural (Self-Sup-	England), W85-01914 5B
Heavy Metals in Ulva lactuca Collected within	plied) Water Use in Florida Through Year 2020,	
Tolo Harbour, An Almost Landlocked Sea, W85-01762 5B	W85-02036 7C	LIDSTROM, M. E.
	LEATHERMAN, S. P.	Seasonal Study of Methane Oxidation in Lake Washington,
LABADIE, J. W. Real Time Irrigation Scheduling via 'Reaching'	Recent Vertical Accretion Rates at Blackwater Wildlife Refuge,	W85-02134 2H
Dynamic Programming,	W85-01809 2L	LIDZBA, B.
W85-02155 3F	LEE, G. F.	XXVI CFMT - Exhibition of Scientific and
LACOCK, D. L.	Fishable Waters Everywhere: An Appropriate	Technical Achievement of Youth in the Water-
Water Resources Data, Kansas Water Year 1982.	Goal, W85-01850 6B	management Industry, W85-01875 5G
W85-01932 2E		•
LADEWSKI, T. B.	LEE, HB. Chemical Derivatization Analysis of Pesticide	LIETZOW, J. S. Occurrence of the Asiatic Clam Corbicula flu-
Influence of the St. Marys River Plume on Northern Lake Huron Phytoplankton Assem-	Residues. VIII. Analysis of 15 Chlorophenols in Natural Water by In Situ Acetylation,	minea in the Maumee River and Western Lake Erie,
blages, W85-01756 2H	W85-02113 5A	W85-01753 5C
LAHL, U.	LEE, V. D. Predicting Variability in a Lake Ontario Phos-	LIJKLEMA, L.
Determination of Organohalogenic Acids in	phorous Model,	Dynamic Phosphate Budget Model for a Eutro-
Water Samples (Bestimmung Halogenorgan- ischer Sauren in Wasserproben),	W85-01758 . 2H	phic Lake, W85-02072 2H
W85-01663 5A	LEENEN, J. D. Wind Induced Diffusion in a Shallow Lake, A	LIMAT, L.
LAM, D. C. L. Mass Balance Models of Phosphorus in Sedi-	Case Study, W85-01763 2H	Transport Phenomena New Experimental Re- sults in Hydrodynamical 'Forced Rayleigh Scat-
ments and Water,		tering' (Phenomenes de Transport Nouveaux
W85-02071 2J	LEIST, D. W. Water Resources Data, Kentucky, Water Year	resultats experimentaux en diffusion 'Rayleigh forcee' hydrodynamic),
LAMB, T. E.	1982,	W85-01745
Water Resources Data, Arkansas, Water Year 1982,	W85-01923 2E	
W85-01934 2E	LEISTRA, M.	LIMONI, B. Determination of Oxidants Formed upon the
LAMBERT, B. F.	Contribution of Leaching of Diazinon, Parath- ion, Tetrachorvinphos and Triazophos from	Disinfection of Drinking Water with Chlorine
Water Resources Data, Arkansas, Water Year	Glasshouse Soils to Their Concentrations in	Dioxide,
1982, W85-01934 2E	Water Courses,	W85-01743 5A
	W85-01961 5B	LIND, W. B.
LAMBING, J. H. Statistical Analysis and Evaluation of Water- Quality Data for Selected Streams in the Coal Area of East-Central Montana,	LEMLEY, A. T. Quantitative Determination of ppb Levels of Carbamate Pesticide in Water by Capillary Gas Chromatography,	
W85-01770 5B	W85-01747 5A	W85-01819 2F

Records of Wells, Drillers' Logs, Water-Level	LUNSFORD, C. A.	MARKS, D. H.
Measurements, and Chemical Analyses of Ground Water in Chambers, Liberty, and Mont- gomery Counties, Texas, 1975-79,	Annual Cycle of Kepone Residue and Lipid Content of the Estuarine Clam, Rangia cuneata, W85-01844 5C	Irrigated Agricultural Expansion Planning in Developing Countries: Income Redistribution
W85-01818 2F	LUTHER, G. W. III	Objective, W85-02143 3F
LINDER-LUNSFORD, J. B.	Tidal and Seasonal Variations of Sulfate Ion in a New Jersey Marsh System,	Irrigated Agricultural Expansion Planning in
Calibration and Verification of a Rainfall-Runoff Model and a Runoff-Quality Model for Several	W85-01848 5B	Developing Countries: Investment Scheduling Incorporating Drainage Water Reuse,
Urban Basins in the Denver Metropolitan Area, Colorado,	LUTZKE, R.	W85-02142 3F
W85-02044 2A	Suggestion for Year-Round Wastewater Utiliza- tion in the Forestry Industry (Vorschlag zur	Irrigated Agricultural Expansion Planning in
LINDHOLM, O. Norwegian Activities on Collection and Re- search on Rainfall Data,	ganzjahrigen Abwasserverwertung in der Forstwirtschaft), W85-01971 5D	Developing Countries: Resilient System Design, W85-02144 6A
W85-01691 2B	MAARSCHALKERWEERD, J.	MARLEY, N. A.
LINDMARK, G. K.	Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D	Determination of Phenols in Water Using Raman Spectroscopy,
Acidified Lakes: Sediment Treatment with Sodium Carbonate - A Remedy,	MACCUBBIN, A. E.	W85-02114 5A
W85-02096 5G	Relative Contributions of Bacteria and Fungi to	MARSALEK, J.
LINDNER, J. B. Geohydrology of the Meadowbrook Artificial-	Rates of Degradation of Lignocellulosic Detri- tus in Salt-Marsh Sediments,	Temporal Distribution of Design Storm Rainfall, W85-01688 2B
Recharge Project Site in East Meadow, Nassau County, New York,	W85-02138 2L	MARSH, B. E.
W85-01774 2F	MAHADEVAN, T. N. Some Observations on the Chemical Composi-	Instrumentation Control and Automation for Eccup Treatment Works,
LIVINGSTON, R. J.	tion of Precipitation in an Industrial Area and It's Use in Air Quality Assessment,	W85-02131 5F
Trophic Response of Fishes to Habitat Variabili- ty in Coastal Seagrass Systems,	W85-02129 5B	MARTIN, C. W.
W85-01890 2L	MAHER, W. A.	Potential for Acidification of Six Remote Ponds in the White Mountains of New Hamphire,
LOESCH, J. G. Kepone Concentration in Juvenile Anadromous	Aromatic Hydrocarbons in Waters of Port Phil- lip Bay and the Yarra River Estuary,	W85-01834 5B
Fishes, W85-01847 5B	W85-01644 5B	MARTIN, D. F.
LOGAN, T. J.	MAIDMENT, D. R. Microcomputer Programs for Designing Water	Dehalogenation of Three Chlorinated Hydrocar- bons: Amine-Assisted Versus Metal-Chelate As-
Effects of Phosphate Fertilizer Applications and	Systems, W85-01903 8A	sisted,
Chemistry-Mineralogy of the Iron Oxide System on Phosphate Adsorption-Desorption by Stream	MAISON, B.	W85-02121 5F
Sediments, W85-01794 5B	Remote Monitoring and Optimisation of Pump-	Investigation of Two Possible Modes of Action of the Inert Dye Aquashade on Hydrilla,
Mechanisms for Release of Sediment-Bound	ing at the Syndicat des Eaux of La Haute-Loue (Telesurveillance et Optimisation du Pompage	W85-02122 4A
Phosphate to Water and the Effects of Agricul- tural Land Management on Fluvial Transport of	du Syndicat des Eaux de La Haute-Loue), W85-02005 5F	MARTINI, I. P.
Particulate and Dissolved Phosphate,	MALHOTRA, V. M.	Morphology and Recent Sediments of the Lower Anastomosing Reaches of the Attawapis-
W85-02095 5B	Measurement of Concrete Permeability, W85-01714 8F	kat River, James Bay, Ontario, Canada, W85-01734 2J
LOGANATHAN, G. V. Effects of Urbanization on Frequencies of Over-	MALLEVIALLE, J.	
flows and Pollutant Loadings from Storm Sewer Overflows: A Derived Distribution Approach,	Potential Use of Enzymes as Catalysts in Drink-	MASKE, S. J. Water Hyacinth Canopy and Pan Evaporation,
W85-02152 5B	ing Water for the Oxidation of Taste Causing Substances,	W85-02128 4A
LOHMILLER, P. A.	W85-02021 5F	MATISOFF, G.
Computerized Distribution Records- CADD Paves the Way,	MALONEY, S. W. Potential Use of Enzymes as Catalysts in Drink-	Flux of Reduced Chemical Constituents (Fe(2+), Mn(2+), NH4(+) and CH4) and Sedi-
W85-01902 5F	ing Water for the Oxidation of Taste Causing Substances,	ment Oxygen Demand in Lake Erie, W85-02087 2H
LOMAX, K. M. Blue Crab Processing Plant Effluent Treatment,	W85-02021 5F	MATSUNAGA, K.
W85-01741 5D	MANEM, J.	Behavior of Organically-Bound Iron in Seawater
LOPP, H. Energy Studies of Wastewater-Treatment Facili-	Potential Use of Enzymes as Catalysts in Drink- ing Water for the Oxidation of Taste Causing	of Estuaries, W85-01913 2L
ties as a Basis for Optimal Energy Use (Ener-	Substances, W85-02021 5F	MATTHES, W. J. JR.
giestudien von Abwasserbehandlingsanlagen als Grundlage fur den optimalen Energieeinsatz),	MANKER, D. C.	Water Resources Data, Iowa, Water Year 1982,
W85-01878 5D	Investigation of Two Possible Modes of Action of the Inert Dye Aquashade on Hydrilla,	W85-01931 2E
LOSEY, G. T. Magnitude and Frequency of Floods from	W85-02122 4A	MATULICH, S. C. Breeding Mallard (Anas platyrhynchos) Habitat
Urban Streams in Leon County, Florida,	MANN, C. K.	Suitability Model,
W85-02047 4A	Determination of Phenols in Water Using Raman Spectroscopy,	
LUM, W. E. II Fluoride, Nitrate, and Dissolved-Solids Concen-	W85-02114 5A	MAVINIC, D. S. Aerobic Sludge Digestion with pH Control
trations in Ground Waters of Washington, W85-01828 2F	MANZIG, J. G. W. Legal Aspects of Acidic Precipitation,	Preliminary Investigation,
LUMIA, R.	W85-01669 6E	
Floods of August 7-8, 1979, in Chautauqua County, New York, with Hydraulic Analysis of	MARENGO, G. Sedimentation Rates in a Swiss-Italian Lake	MAYASICH, J. M. Effects of the Herbicide Atrazine on an Oyster
Canadaway Creek in the Village of Fredonia,	Measured with Sediment Traps,	Food Organism,
W85-02051 2E	W85-02100 2J	W85-01808 5C

5C

MCCAULEY, J. R. Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined Areas of Southeastern Kansas, W85-01947 5B	terfalls of Guterstein and Urach (Schwabische Alb) (Kinetische Faktoren der CaCO3-Abschei- dung und der Fraktionierung von 12C und 13C. Untersuchungen an den Wasserfallen von Guter- stein und Urach (Schwabische Alb)),	MILLS, G. L. Urban Runoff as a Source of Polycyclic Arc matic Hydrocarbons to Coastal Waters, W85-02108
	W85-01662 1B	MILLS, S. V.
MCCLYMONDS, N. E. Potential Effects of Surface Coal Mining on the	MERKEL, W.	Mechanics of Mudflows, W85-01816
Hydrology of the Corral Creek Area, Hanging Woman Creek Coal Field, Southeastern Mon-	Water Supply in the Federal Republic of Ger-	
tana,	many, W85-02002 6D	MING, E. G. Water Resources Data, Alabama, Water Yes
W85-02040 5B	MERRY, C. E.	1982,
MCCORQUODALE, J. A.	Water Resources Data, Kansas Water Year	W85-01939 21
Hydrodynamic of Circular Primary Clarifiers, W85-01716 5D	1982, W85-01932 2E	MIRCHANDANI, I.
	20	Appropriate Water Supply Technology for De
MCDONALD, T. J.	MESNIER, R.	veloping Countries,
Volatile Organic Inputs from an Ocean Outfall Near Barceloneta, Puerto Rico,	Enzymatic Hydrolysis Tests on an Industrial Effluent Prior to its Biological Purification	W85-01981 5
W85-01963 5E	(Essais d'Hydrolyse Enzymatique d'un Effluent	MITCHELL, D. T.
MCFADYEN, J. A.	Industriel avant son Epuration Biologique), W85-01975 5D	Disposal of Household Wastewater in Soils of High Stone Content (1981-1983),
Yield and Quality of Cotton Grown with		W85-01815 51
Wastewater,	METCALF, J. L.	
W85-01869 5D MCGARVIE, S. D.	Aquatic Leeches (Hirudinea) as Bioindicators of Organic Chemical Contaminants in Freshwater	MITCHELL, W. R. Microbial Degradation of 2,4,6-Trichloroanilin
Major Aquifers in Miner County, South Dakota,	Ecosystems, W85-01958 5A	in Aquatic Samples and Laboratory Enrichmer Cultures,
W85-01950 2F	W65-01556	W85-02120 5
MCINTOSH, A.	MEYERSON, A. L.	W 63-02120
Accumulation of the Trace Elements Lead and	Tidal and Seasonal Variations of Sulfate Ion in a	MITWALLI, H.
Zinc by Asellus communis at Three Different	New Jersey Marsh System, W85-01848 5B	Chlorine as an Algicide in a Conventional Water
pH Levels,	W 02-01040	Treatment Plant,
W85-01795 5B	MICHAELIS, J.	W85-01749 5
MCINTOSH, T. H.	Kinetic Factors of CaCO3-Precipitation and the	MOENCH, A. F.
Role of Sediments in the Nitrogen Budget of	Partitioning of 12C and 13C. Studies at the Wa- terfalls of Guterstein and Urach (Schwabische	Double-Porosity Models for a Fissured Ground
Lower Green Bay, Lake Michigan, W85-01754 5B	Alb) (Kinetische Faktoren der CaCO3-Abschei-	water Reservoir with Fracture Skin, W85-02150 2
	dung und der Fraktionierung von 12C und 13C.	1103-02130
MCKAY, W. A. Hydrogeochemical Investigation of Thermal	Untersuchungen an den Wasserfallen von Guter- stein und Urach (Schwabische Alb)),	MOLENAAR, D.
Springs in the Black Canyon-Hoover Dam Area,	W85-01662 1B	Occurrence, Quality, and Use of Ground Water in Orcas, San Juan, Lopez, and Shaw Island
Nevada and Arizona,	MILES, C. J.	San Juan County, Washington,
W85-01804 2K	Determination of Aldicarb and its Derivatives in	W85-02043 70
MEAGHER, R. F.	Groundwaters by High-Performance Liquid	MOTTER TO
Computer Controlled Operation of an Activated	Chromatography with UV Detection,	MOLLER, FW.
Sludge Plant,	W85-01748 5A	Friedrichroda Wastewater Treatment Facility Results of an Experiment (Klaranlage Friedrich
W85-01652 5D	MILES, M. G.	roda - Ergebnisse eines Experiments),
MEDEIROS, C.	Formation of Stable Organic Chloramines	W85-01884 51
Laboratory Assessment of the Toxicity of Urban	During the Aqueous Chlorination of Cytosine	MONTGOMERY, H. A. C.
Runoff on the Fathead Minnow (Pimephales promelas),	and 5-Methylcytosine, W85-01726 5F	Growth of Cladophora glomerata in a Rive
W85-02124 5C		Receiving Sewage Effluent,
	MILFORD, S. N.	W85-01723 5
MEDINA, M. A. JR.	Eulerian-Lagrangian Solution of the Convec- tion-Dispersion Equation in Natural Coordi-	MONTGOMERY, R. H.
Integrated Methodology for Instream Flow Strategies,	nates.	Predicting Variability in a Lake Ontario Pho
W85-01951 5B	W85-02162 1B	phorous Model,
MEEN A WOLLY W	MILET B	W85-01758 21
MEENAKSHY, V. Some Observations on the Chemical Composi-	MILKI, R. Change in Quality of Thermal Groundwater	MONTIJN, A.
tion of Precipitation in an Industrial Area and	From a Unique Resource in Lebanon,	Release of Sediment-Phosphorus and the Influ
It's Use in Air Quality Assessment,	W85-01673 2F	ence of Algal Growth on This Process,
W85-02129 5B	MILLER, A. C.	W85-01761 21
MEIJER, M. L.	Changes in the Naiad Fauna of the Cumberland	MOORE C. S.
Available Phosphorus in Lake Sediments in the	River below Lake Cumberland in Central Ken-	MOORE, G. S. Lack of Nephrotoxicity in the Rat by Sodium
Netherlands,	tucky,	Chlorite, a Possible Byproduct of Chiorine D
W85-02092 2H	W85-01921 6G	oxide Disinfection in Drinking Water,
MELCER, H.	MILLER, D. C.	W85-02119 5
Two-Stage Biological Fluidized Bed Treatment	Effects of Copper and Cadmium on Growth,	MOORE, W. S.
of Coke Plant Wastewater for Nitrogen Control,	Swimming and Predator Avoidance in Euryte-	226Ra and 228Ra in the Mixing Zones of the Pe
W85-01655 · 5D	mora affinis (Copepoda), W85-01900 5C	Dee River-Winyah Bay, Yangtze River an
MELFI, D. A.	W85-01900 5C	Delaware Bay Estuaries,
Analysis of Total Phosphorus Transport in	MILLER, J. E.	W85-01912 2
River Systems,	Basic Concepts of Kinematic-Wave Models,	MORALES-ALAMO, R.
W85-02074 2E	W85-02035 2Å	Uptake of Kepone from Sediment Suspension
MENSCHEL, G.	MILLINGTON, P.	and Subsequent Loss by the Oyster Crassostre
Kinetic Factors of CaCO3-Precipitation and the	Case for Automated Water Management,	virginia,
Partitioning of 12C and 13C. Studies at the Wa-	W85-02130 6A	- W85-01897 5

5B

MORRIS, R. Enteric Virus Levels in Wastewater Effluents and Surface Waters in the Severn Trent Water	NAIR, P. S. Effects of Phosphate Fertilizer Applications and Chemistry-Mineralogy of the Iron Oxide System	River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine Mixing,
Authority 1979-1981, W85-01718 5B	on Phosphate Adsorption-Desorption by Stream Sediments,	W85-01837 5B
MOSTEV M D	W85-01794 5B	NOSS, R. R.
MOSLEY, M. P. Critical Depths for Passage in Braided Rivers,	NASSER, A.	Evaluation of the Visibility Criterion of the Mas-
Canterbury, New Zealand,	Simultaneous Concentration of Four Enterovir-	sachusetts Sanitary Code for Swimming in Natural Waters,
W85-01636 2E	uses from Tap, Waste, and Natural Waters,	W85-01800 6E
Moon o	W85-02137 5A	
MOSS, C. Selected Bibliography of Water Resources Pub-	NEAME, P. A.	NUTT, S. G.
lications for Mississippi, W85-02033	Distribution and Concentrations of Naturally- Occurring Radionuclides in Sediments in a Ura- nium Mining Area of Northern Saskatchewan,	Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control, W85-01655 5D
MOTE, C. R.	Canada, W85-02083 5B	O'GRADY, D. P.
Disposal of Household Wastewater in Soils of	W 63-02063	Toxicity of Organic Mixtures Saturated in Water
High Stone Content (1981-1983), W85-01815 5D	NEELY, W. B.	to Daphnia magna. Effect of Compositional
	Analysis of Aquatic Toxicity Data: Water Solu- bility and Acute LC50 Fish Data.	Changes, W85-01953 5C
MOUCHET, P.	W85-01966 5C	W 0.5-01555
Potable Water Treatment in Tropical Countries:		O'NEIL, E. J.
Recent Experiences and Some Technological Trends.	NELSON, L. M.	Pesticides in Groundwater Beneath the Central
W85-02022 5F	Flood Elevations for the Soleduck River at Sol Duc Hot Springs, Clallam County, Washington,	Sand Plain of Wisconsin, W85-02025 5B
	W85-01773 4A	W 63-02023
MULLER, A.		O'NEILL, M. P.
Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi-	NEMBRINI, G. Interaction Between Interstitial Water and Sedi-	Objective Identification of Pools and Riffles,
ty and Physico-chemical Conditions in Compart-	ment in Two Cores of Lac Leman, Switzerland,	W85-02159 2E
ments of a Freshwater Pond,	W85-02084 2H	OBEYSEKERA, J. T. B.
W85-01967 5C	Warner Calabata I and Calabata	Estimation of Skewness of Hydrologic Varia-
BATTER/ABITER V SI	Manganese Cycle in Lac Leman, Switzerland: The Role of Metallogenium,	bles,
MULVANEY, J. N. Legal Aspects of Acidic Precipitation,	W85-02081 2H	W85-02161 2A
W85-01669 6E		OGLESBY, J. L.
	NEMEROW, N.	Responses of Developing Estuarine Macro-
MUR, L. R.	Heavy Metal Migration in Soil-Leachate Sys- tems,	benthic Communities to Drilling Muds,
Influence of Simulated Groundwater-Movement on the Phosphorus Release from Sediments, as	W85-01868 5B	W85-01845 5C
Measured in a Continuous Flow System,		OCTIONIA TA TA O
W85-02094 2F	NESTRICK, T. J. Determination of 2.3,7.8-Tetrachlorodibenzo-p-	OGUGBUAJA, V. O. Analysis of Aqueous Sediments for Heavy
	Dioxin in Treated Wastewater,	Metals,
Release of Sediment-Phosphorus and the Influ- ence of Algal Growth on This Process,	W85-01729 5A	W85-01742 5B
W85-01761 2H	NIETZER A	
	NETZER, A. Adsorption of Copper, Lead and Cobalt by Ac-	OGUNROMBI, J. A. Effects of Baffles on the Performance of Model
MURATA, C.	tivated Carbon,	Waste Stabilization Ponds,
Adsorption of Surfactants on Sediments, W85-01960 5A	W85-01717 5D	W85-01719 5D
W85-01900 5A	NEWCHURCH, E. J.	
MURPHY, T. J.	Heavy Metals in the Lower Mississippi River,	OKUN, D. A.
Net Atmospheric Inputs of PCBs to the Ice	W85-01744 5B	Practical Water Treatment for Communities in Developing Countries,
Cover on Lake Huron, W85-01759 5B	NEWELL, S. Y.	W85-01983 5F
W 63-01/39	Relative Contributions of Bacteria and Fungi to	
MURRAY, G. E.	Rates of Degradation of Lignocellulosic Detri-	OMANG, R. J.
Effect of Chlorination on Antibiotic Resistance	tus in Salt-Marsh Sediments,	Streamflow Characteristics of the Yellowstone River Basin, Montana, Through September
Profiles of Sewage-Related Bacteria,	W85-02138 2L	1982,
W85-02139 5D	NGUYEN, V. T. V.	W85-01781 2E
MUSQUERE, P.	Stochastic Characterization of Temporal Storm	
Remote Monitoring and Optimisation of Pump-	Patterns,	ONGLEY, E. D. Physical and Geochemical Characteristics of
ing at the Syndicat des Eaux of La Haute-Loue	W85-01686 2B	Suspended Solids, Wilton Creek, Ontario,
(Telesurveillance et Optimisation du Pompage du Syndicat des Eaux de La Haute-Loue),	Stochastic Description of Temporal Daily Rain-	W85-02056 2H
W85-02005 5F	fall Patterns,	
	W85-01712 2B	OPPERMANN, R.
MYETTE, C. F.	NIELSEN, K.	Forecasting of Water Level and Discharge of the Elbe with the Aid of Fuzzy Modelling (Vor-
Appraisal of Water from Surficial-Outwash Aquifers in Todd County and Parts of Cass and	Control of Metal Contaminants in Drinking	hersage von Wasserstand und Durchfluss für die
Morrison Counties, Central Minnesota,	Water in Denmark,	Elbe mit Hilfe einer unscharfen Modellierung),
W85-02038 4B	W85-01993 5F	W85-01973 2E
MULIDOTAD I A	NIEMCZYNOWICZ, J.	ORAVAINEN, R.
MYHRSTAD, J. A. Drinking Water in Developing Countries - The	Review of Rainfall Data Application for Design	Zinc in Water and Sediments of Two Finnish
Minimum Treatment Philosophy. A Case Study,	and Analysis, W85-01677 2B	Lakes,
W85-02018 3B		W85-02065 5B
NAT A	NOBLE, R. D.	OSCARSON, D. W.
NAF, A. New Materials in Pipe Networks - Special Con-	Vertical Temperature Distribution in Lakes, W85-01651 2H	Dynamics and Mechanisms of Arsenite Oxida-
sideration of Internal Coatings,	W85-01651 2H	tion by Freshwater Lake Sediments,
W85-01997 2G	NOLTING, R. F.	W85-02080 5B
	River Elbe: Processes Affecting the Behaviour	OCYAN C
NAIK, B. Mechanics of Mudflows,	of Metals and Organochlorines During Estuarine Mixing,	OSKAM, G. Quality Aspects of the Biesbosch Reservoirs,
W85-01816 8B	W85-01836 5B	W85-01979 5G

PAGE, R. W. Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California, W85-01941	PAULSON, Q. F. Guide to North Dakota's Ground-Water Re- sources, W85-01824 2F	PFUNDT, H. Various Coating Materials for Potable Water Concrete Storage Reservoirs - Experiences in Germany, Switzerland and Austria,
Data for Ground-Water Test Hole near Nico- laus, Central Valley Aquifer Project, California, W85-01929 7C	PEARMAN, J. L. Water Resources Data, Georgia, Water Year 1982, W85-01938	W85-02000 8G PHELPS, G. G. Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Manage-
PALMATEER, G. Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D	PEARSON, H. W. Study of the Copper-Complexing Compounds	ment District and Vicinity, Florida, W85-02049 7C
PALMER, M. D. Beach Fecal Coliforms, W85-01711 5B	Released by Some Species of Cyanobacteria, W85-01725 5B PEART, D. B. Quality-Assurance Data for Routine Water	PHILIP, J. R. Travel Times from Buried and Surface Infiltra- tion Point Sources, W85-02167 2G
PAPADOPOULOS, A. S. Stochastic Model for BOD and DO in Streams When the Velocity is Random and Distance- Dependent,	Analysis in the Laboratories of the U.S. Geological Survey for Water-Year 1982, W85-01768	PHILIPP, K. R. Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands,
W85-01676 5B PAQUIN, J. L.	PECHER, R. Overflow Data of Rainwater Discharge Systems Determined From Run Off Simulation of Plu-	W85-01805 5B PHILLIPS, C.
Study of Mutagenic Activity in Water in a Pro- gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc-	viograph Records, W85-01698 2E	Evaluation of Fisherman Benefits Stemming from Special Use Fishery Management Pro- grams,
tion a Ozonation Estagee), W85-01987 5F	PEICHL, L. Longterm Effects of the Herbicides Atrazine and Dichlobenil upon the Phytoplankton Densi-	W85-01831 6B PICKETT, R. L.
PARKER, G. G. JR. Selected Bibliography of Water Resources Publications for Mississippi,	ty and Physico-chemical Conditions in Compart- ments of a Freshwater Pond, W85-01967 5C	Satellite-Tracked Current Drifters in Lake Michigan, W85-01760 7B
W85-02033 10C PARKER, J. C. Flux-Averaged and Volume-Averaged Concen-	PEIRIS, N. D. Matara Water Supply Project in Sri Lanka, W85-02013 5F	PICKRILL, R. A. Predominant Headwater Inflow and its Control of Lake-River Interactions in Lake Wakatipu, W85-01638 2H
trations in Continuum Approaches to Solute Transport, W85-02153 2F	PELIGRY, P. Water Decade (La Decennie de l'Eau), W85-01984 6B	Water Temperature and Turbidity in Glacially Fed Lake Tekapo.
PARKER, J. G. Spatial and Temporal Trends in Heavy Metal Concentrations in Mussels from Northern Ire- land Coastal Water, W85-01901 5A	PELLETIER, B. R. Comparison of Sediment Energy-Texture Relationships in Marine and Lacustrine Environments, W85-02058 2J	W85-01637 PIERCE, M. J. Ground Water in the Redding Basin, Shasta and Tehama Counties, California, W85-01945 4B
PARKS, J. W. Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal and Regional Variations, W85-02091 5B	PENNY, M. L. Water Resources Data, Kansas Water Year 1982, W85-01932 2E	PILGRIM, D. H. Time Patterns of Rainfall For Estimating Design Floods on a Frequency Basis, W85-01687 2B
PARLIMAN, D. J. Ground-water Quality in the Western Snake River Basin, Swan Falls to Glenns Ferry, Idaho, W85-01784	PERCIVAL, J. B. Physical and Geochemical Characteristics of Suspended Solids, Wilton Creek, Ontario, W85-02056 2H	PLEBAN, S. Real Time Irrigation Scheduling via 'Reaching' Dynamic Programming, W85-02155 3F
PARTRIDGE, R. M. Satellite-Tracked Current Drifters in Lake Michigan, W85-01760 7B	PERRY, C. A. Flood-Frequency Estimates for Five Gaged Basins in Wichita, Kansas, W85-01949 2A	PLUMB, J. A. Effect of Treatment with a Commercial Bacterial Suspension on Water Quality in Channel Catfish Ponds,
PASQUALE, J. J. Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands, W85-01805 5B	PETERS, J. Release of Sediment-Phosphorus and the Influ- ence of Algal Growth on This Process, W85-01761 2H	W85-01922 5F POLITZKI, G. Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/
PASZTO, P. Wastewater Purification as Related to the Study of a River System (Abwasserreiningung in Ver- bindung mit der Untersuchung eines Flusssys-	PETERS, T. L. Determination of 2,3,7,8-Tetrachlorodibenzo-p- Dioxin in Treated Wastewater, W85-01729 5A	Water Partition Coefficient and Bioaccumula- tion of Organic Chemicals by Alga Chlorella, W85-01959 5B PORTER, J. E.
tems), W85-01885 5D	PETRY, J. Comparison of Water Mains Cleaning Techniques - The Experiment of Begles (Comparai-	Water Resources Data, Arkansas, Water Year 1982, W85-01934 2E
PATEL, M. A. Pilot Plant Demonstration of Biological Phosphorus Removal, W85-01657 5D	son des Techniques de Curage des Conduites d'Eau Potable - L'Experience de Begles), W85-01999 8A PEYTON, G. R.	POST, H. E. Effect of Clear-Cut Silviculture on Dissolved Ion Export and Water Yield in the Piedmont, W85-02171 5B
PATTERSON, J. W. Metals Distributions in Activated Sludge Sys- lems,	Investigation of Photocatalytic Oxidation for Wastewater Cleanup and Reuse, W85-01813 5D	POST, L. E. Mixing Zone Studies in the Grand River Basin,
W85-01737 5D	PFUND, R.	W85-01710 5B
PAULSON, L. J. Limnology in Reservoirs on the Colorado River, W85-01812 2H	Planning, Implementation of Directives and Pipelaying Standards, W85-01998 6B	POTTENGER, L. H. Study of Mutagenic Activity in Water in a Progressive Ozonation Unit (Etude du Caractere

Mutagene de l'Eau dans une Filiere de Produc- tion a Ozonation Estagee), W85-01987 5F	RAND, J. A. Microwave Measurements of Moisture Distribu- tions in the Upper Soil Profile,	REECE, D. A. Sedimentation Success from Modified Jar Tests, W85-01910 5F
PRAHL, F. G. Hydrocarbons in Washington Coastal Sediments,	W85-02160 2G RANDAZZO, A. F. Classification and Description of Dolomitic Fab-	REED, F. C. Acid Precipitation and Scientific Uncertainty Problems in Probability,
W85-01915 5B	rics of Rocks from the Floridan Aquifer, U.S.A., W85-01733	W85-01665 5C
PREMAZZI, G. Sedimentation Rates in a Swiss-Italian Lake Measured with Sediment Traps, W85-02100 2J	RANZAU, C. E. Records of Wells, Drillers' Logs, Water-Level Measurements, and Chemical Analyses of	REED, G. D. Sedimentation Success from Modified Jar Tests, W85-01910 5F
PRIES, J. H. Two-Stage Biological Fluidized Bed Treatment of Coke Plant Wastewater for Nitrogen Control, W85-01655 5D	Ground Water in Brazoria, Fort Bend, and Waller Counties, Texas, 1975-79, W85-01819 2F Records of Wells, Drillers' Logs, Water-Level	REEVES, M. J. MINES: A Model to Forecast Mine Wastewater Quality, W85-01750 5B
PRINCZ, P. New Instrumentation in Automatic Water Quality Monitoring, W85-02007 5G	Measurements, and Chemical Analyses of Ground Water in Chambers, Liberty, and Mont- gomery Counties, Texas, 1975-79, W85-01818 2F	REVITT, D. M. Hydrocarbon Accumulation in Freshwater Sediments of an Urban Catchment, W85-02078 5B
PRITCHETT, J. W. Pressure Transient Analysis for Two-Phase Geothermal Wells: Some Numerical Results, W85-02163 2F	RAO, A. R. Depth-Duration Models of Short Time Increment Rainfall, W85-01683 2B	REYNOLDSON, T. B. JR. Spatial Heterogeneity in Whole Lake Sediments - Towards a Loading Estimate, W85-02073 2H
PUCCIA, R. J. Computer-Assisted Water System Analysis and Design for Charleston, S.C., W85-01907 5F	RAO, A. V. Agricultural Droughts at Peddapuram, East Go- davari District, Andhra Pradesh, W85-02126 2I	RHEAD, M. M. Initial Studies on the Use of High-Performance Liquid Chromatography for the Rapid Assessment of Sewage Treatment Efficiency,
PUCHER, E. Hydroelectric Power Station at the Netstal Lime Factory (Das Wasserkraftwerk der Kalkfabrik Netstal AG), W85-01866 8A	RAO, S. S. Oxygen Depletion in Central and Eastern Lake Erie: Relationship with Bacteria, Chlorophyll, POC, and Morphometry, W85-01752 2H	W85-01721 5D RHONES, L. Changes in the Naiad Fauna of the Cumberland River below Lake Cumberland in Central Ken-
PURCELL, T. W. III	RAOUS, P.	tucky, W85-01921 6G
Effects of Runoff from Undeveloped Versus Lightly Developed Watersheds on Tropical Planktonic Ecosystem, W85-01810 5C	Areal Reduction Factors on Short Time and Space Intervals, W85-01690 2B RAPIN, F.	RICHARDS, J. T. Formation of Stable Organic Chloramines During the Aqueous Chlorination of Cytosine and 5-Methylcytosine.
PUTZ, G. Microorganism Survival in an Ice-Covered River,	Arsix, F. Arsix, F.	W85-01726 5F Kinetics and Products of the Chlorination of
W85-01708 5B	W85-02064 2J	Caffeine in Aqueous Solution, W85-01727 5B
QUENTIN, KE. Determination of Chlorine Dioxide and Chlorite in Drinking-Water (Bestimmung von Chlor- dioxid und Chlorit im Trinkwasser),	RATHORE, L. S. Water Hyacinth Canopy and Pan Evaporation, W85-02128 4A	RIDGWAY, H. F. Biological Fouling of Reverse Osmosis Membranes, W85-01977 5D
W85-01664 5F	RATZLAFF, K. W. Records of Wells, Drillers' Logs, Water-Level	
QUIMPO, R. G. Rainfall Energy From Drop Size Data, W85-01696 2B	Measurements, and Chemical Analyses of Ground Water in Brazoria, Fort Bend, and Waller Counties, Texas, 1975-79, W85-01819 2F	RIGLER, F. H. Dependence of Hypolimnetic Oxygen Consump- tion on Ambient Oxygen Concentration: Fact or Artifact,
QUINLIVAN, S. Characteristics of Leachates from Hazardous Waste Landfills, W85-02118 5B	Records of Wells, Drillers' Logs, Water-Level Measurements, and Chemical Analyses of Ground Water in Chambers, Liberty, and Mont-	W85-02149 2H RIPPEY, B. Rates of Sediment-Water Exchange of Oxygen
QUINN, J. G. Urban Runoff as a Source of Polycyclic Aromatic Hydrocarbons to Coastal Waters,	gomery Counties, Texas, 1975-79, W85-01818 2F	and Sediment Bioturbation in Lough Neagh, Northern Ireland, W85-02085 2H
W85-02108 5B RAHEL, F. J.	RAV-ACHA, CH. Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine Dioxide,	RITACCO, P. J. Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte-
Factors Structuring Fish Assemblages Along a Bog Lake Successional Gradient, W85-01891 2H	W85-01743 5A RAZEM, A. C.	mora affinis (Copepoda), W85-01900 5C
RAHN, P. H. Flood-plain Management Program in Rapid City, South Dakota, W85-01643 2E	Ground-Water Hydrology and Quality before and after Strip Mining of a Small Watershed in Jefferson County, Ohio, W85-01943	RITTMANN, B. E. Nonsteady-State-Biofilm Process for Advanced Organics Removal, W85-01658 5D
RAMAN, V. Status of Research and Development in Water Supply Systems in India, W85-01982 3D	REBHUN, M. Contact Flocculation-Filtration of Humic Sub- stances, W85-01722 5D	RIVIERE, D. Impact of Domestic Sewage Pollution on Enzymatic Activities of Two Planktonic Copepods (Acartia clausi and Centropages typicus) (Impact d'une Pollution d'Origine Urbaine sur
RAMASWAMY, S. N. Trace Metal Concentrations of the Waters of a South Indian River, W85-01751 5B	RECKHOW, K. H. Predicting Variability in a Lake Ontario Phos- phorous Model, W85-01758 2H	les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty- picus)), W85-01898 5C

ROBERSON, J. A.

ROBERSON, J. A. Mechanics of Mudflows, W85-01816 8B	RULIFSON, R. A. Traveling Screens as Sampling Gear for Vertical Distribution Studies,	SAWYER, S. W. State Laws Mandating Water Conservation, W85-01806 6E
W05-01010	W85-01842 7B	W 63-01800 UE
ROBERTS, M. H. JR. Acute Toxicity of Kepone to Selected Freshwater Fishes.	RUST, B. R. Sedimentation in Fluvial and Lacustrine Envi-	SCHAFRAN, G. C. Short-Term Changes in the Base Neutralizing
W85-01846 5C	ronments, W85-02057 2J	Capacity of an Acid Adirondack Lake, New York,
ROBINSON, M. P. JR.	11 63-02037	W85-01917 5B
Pump Station Design: The Benefits of Computer	RUSTEN, B.	
Modeling, W85-01905 8C	Wastewater Treatment with Aerated Submerged Biological Filters, W85-01736 5D	SCHALEKAMP, M. All About Ozone - Its Advantages and Disad-
ROELOFS, J. G. M.	1100-01100	vantages in Treating Water, W85-01986 5F
Impact of Acidification and Eutrophication on Macrophyte Communites in Soft Waters. II. Ex-	RUTLEDGE, E. M. Disposal of Household Wastewater in Soils of	
perimental Studies, W85-01889 5C	High Stone Content (1981-1983), W85-01815 5D	Report on the Water Supply of the People's Republic of China, W85-01995 5F
BOGERG F	RYALS, G. N.	W85-01995 5F
ROGERS, K. Tidal and Seasonal Variations of Sulfate Ion in a	Regional Geohydrology of the Northern Louisiana Salt-Dome Basin, Part III, Potentiometric	Review of the Water Supply in the Soviet
New Jersey Marsh System, W85-01848 5B	Levels of the Wilcox-Carrizo and Sparta	Union, W85-02012 5F
ROLAN, R. G.	Aquifers,	
Preliminary Findings of the Priority Pollutant	W85-01785 2F	Water Supply of Alexandria Egypt, W85-01985 5F
Monitoring Project of the Nationwide Urban	RYDING, SO. Lake Trehorningen Restoration Project.	
Runoff Program, W85-01661 5A	Changes in Water Quality after Sediment	SCHEIDEL, R. H. Oil Spill Focuses Attention on the Problems of a
ROLLINS, H. C.	Dredging,	Man-Made Recreational Lake,
Water Resources Data, Alabama, Water Year	W85-02097 5G	W85-01650 5B
1982,	SACKS, R. S. Ann Arbor Controls Trihalomethanes,	SCHERTZER, W. M.
W85-01939 2E	W85-01911 5F	Mass Balance Models of Phosphorus in Sedi-
ROSE, J. B. Detection of Enteric Viruses in Treated Drink-	SADEGHI, A. M.	ments and Water,
ing Water,	Microwave Measurements of Moisture Distribu-	W85-02071 2J
W85-02136 5F	tions in the Upper Soil Profile, W85-02160 2G	SCHILLING, W.
ROSENBERG, A.	W85-02160 2G	Effect of Spatial Rainfall Distribution on Sewer
Fate of epsilon-Caprolactam in the Aquatic En-	SADEGHIPOUR, J.	Flows,
vironment, W85-01956 5B	Parameter Identification of Groundwater Aqui- fer Models: A Generalized Least Squares Ap-	W85-01689 2E
ROSENCRANCE, A. B.	proach, W85-02164 2F	Real-Time Estimation and Forecasting of Spa- tially Distributed Areal Rainfall,
Microbial Degradation of 2,4,6-Trichloroaniline	SAEED, M.	W85-01700 2B
in Aquatic Samples and Laboratory Enrichment Cultures,	Effect of Treatment with a Commercial Bacte-	
W85-02120 5B	rial Suspension on Water Quality in Channel	Univariate Versus Multivariate Rainfall Statis- tics - Problems and Potentials,
ROSSI, F.	Catfish Ponds, W85-01922 5F	W85-01685 2B
Two-Component Extreme Value Distribution	W65-01922	
for Flood Frequency Analysis,	SAIN, P.	SCHINSKY, A. W.
W85-02151 2E	Decomposition of Wild Rice (Zizania aquatica) Straw in Two Natural Lakes of Northwestern	Net Atmospheric Inputs of PCBs to the Ice Cover on Lake Huron,
ROSSO, R. Nash Model Relation to Horton Order Ratios,	Ontario, W85-01647 2H	W85-01759 5E
W85-02158 2A	W85-01647 2H	SCHMITT, C. J.
POSSON M P	SAITO, M.	Bioavailability of Pb and Zn from Mine Tailings
ROSSOW, M. P. Sheetpile Interlock Tension in Cellular Coffer- dams,	Adsorption of Surfactants on Sediments, W85-01960 5A	as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in
W85-01872 8A	SALAS, A. C. Reduction of Costs and Liability Risks in Elec-	Suckers (Pisces: Catostomidae), W85-01918 5A
ROWBOTTOM, I. A.	troplating Wastewater Treatment,	
Time Patterns of Rainfall For Estimating Design Floods on a Frequency Basis,	W85-01852 5D	SCHOFER, G.
W85-01687 2B	SALOMONS, W.	Construction of Rationalization Equipment a the Rostock Water-Supply and Wastewater
	Standardization of Methods of Analysis for	treatment Facility (Rationalisierungsmittelbat
ROWLEY, A. G. Mechanisms of Metal Adsorption from Aqueous	Heavy Metals in Sediments, W85-02104 5A	im VEB Wasserversorgung und Abwasserbe
Solutions by Waste Tyre Rubber,	SAMMIS, T. W.	handlung Rostock), W85-01877 51
W85-01724 5D	Water-Use Production Functions of Selected	33-01077
RUARDIJ, P.	Agronomic Crops in Northwestern New	SCHOLZE, C.
One-Dimensional Mixing and Flushing Model of the Ems-Dollard Estuary: Calculation of Time	Mexico, Phase II, W85-01817 3F	Observations from the Test Operation of an Ion exchange Facility for Nitrate Removal in Drink
Scales at Different River Discharges, W85-01838 2L	SATHE, A. P.	ing-water Treatment (Erfahrungen aus dem Er
	Some Observations on the Chemical Composi-	probengsbetrieb einer Ionenaustauscheranlag zur Nitratelimination in der Trinkwasseraufber
Use of a Model to Assess Factors Affecting the Oxygen Balance in the Water of the Dollard, W85-01839 2L	tion of Precipitation in an Industrial Area and It's Use in Air Quality Assessment, W85-02129 5B	eitung), W85-01974
RUBIN, A. J.	SATSMADJIS, J.	SCHROEDER, P. R.
Coagulation and Restabilization of Particulate,	Mytilus galloprovincialis and Parapenaeus lon-	Coagulation and Restabilization of Particulate
Macromolecular and Protected Organic Aqua- sols by Aluminum (III),	girostris as Bioindicators of Heavy Metal and	Macromolecular and Protected Organic Aqua sols by Aluminum (III),
W85-02105 5F	Organochlorine Pollution, W85-01899 5A	
91	JA.	30 02100

5F

SCHROER, W.	SHAHA, S. K.	SMITH, D. W.
Determination of Organohalogenic Acids in Water Samples (Bestimmung Halogenorgan-	Water Hyacinth Canopy and Pan Evaporation, W85-02128 4A	Microorganism Survival in an Ice-Covered River.
ischer Sauren in Wasserproben), W85-01663 5A	SHALASH, S.	W85-01708 5B
	Effects of Sedimentation on the Storage Capac-	SMITH, H.
SCHULHOF, P. 2001 The Future of Water Treatment (2001	ity of the High Aswan Dam Reservoir, W85-02101 4A	Land Use, Runoff and Recharge on Selected
L'Avenir du Traitement de l'Eau),	SHARP, D. N.	Watersheds in the U.S. Virgin Islands,
W85-02017 6A	Enteric Virus Levels in Wastewater Effluents	W85-01799 4C
SCHULTZ, B.	and Surface Waters in the Severn Trent Water	SMITH, J. D.
Determination of 4-Aminophenol in Water by	Authority 1979-1981, W85-01718 5B	Aromatic Hydrocarbons in Waters of Port Phil-
High-Performance Liquid Chromatography		lip Bay and the Yarra River Estuary,
with Fluorescence Detection, W85-01746 5A	SHARPE, W. E. Best creation of Failing On Site Westernster Die	W85-01644 5B
	Restoration of Failing On-Site Wastewater Dis- posal Systems Using Water Conservation,	SMITH, R.
SCHULZ, C. R. Practical Water Treatment for Communities in	W85-01656 5D	Organization and Evaluation of Interlaboratory
Developing Countries,	SHEDLOCK, R. J.	Comparison Studies among Southern African Water Analysis Laboratories,
W85-01983 5F	Shallow Ground-Water Flow and Drainage	W85-02117 5A
SCHUURKES, J. A. A. R.	Characteristics of the Brown Ditch Basin near	
Impact of Acidification and Eutrophication on	the East Unit, Indiana Dunes National Lake- shore, Indiana, 1982,	SMITH, R. L.
Macrophyte Communites in Soft Waters. II. Ex-	W85-01948 4A	Quantifying the Relative Performance of Alter- native Measures for Fulfilling Instream Uses in
perimental Studies, W85-01889 5C	SHELTON, L. R.	the Plains Environment,
	Water Resources Data, Kansas Water Year	W85-02107 6B
SCHWARZER, R. R. Analysis of Aqueous Sediments for Heavy	1982,	COLUMN A T TA
Metals,	W85-01932 2E	SMITS, A. J. M. Impact of Acidification and Eutrophication on
W85-01742 5B	SHIRASUKA, K.	Macrophyte Communites in Soft Waters. II. Ex-
SCOTT, H. D.	Material Balance Analysis for Fluoride Ions in Experimental Waste Disposal Plant,	perimental Studies,
Microwave Measurements of Moisture Distribu-	W85-01732 5D	W85-01889 5C
tions in the Upper Soil Profile, W85-02160 2G	SIDLE, R. C.	SNODGRASS, R. D.
	Prediction of Peak Flows for Culvert Design on	Deepwater Sediments and Trophic Conditions
SCOTT-WASILK, J.	Small Watersheds in Oregon,	in Florida Lakes,
Occurrence of the Asiatic Clam Corbicula flu- minea in the Maumee River and Western Lake	W85-01820 4A	W85-02099 2H
Erie,	SIMMONS, C. E.	SNODGRASS, W. J.
W85-01753 5C	Effects of Channel Excavation on Water-Quality Characteristics of the Black River and on	Experimental Measurement of Sediment Nitrifi-
SCRIVENER, J. C.	Ground-Water Levels near Dunn, North Caroli-	cation and Denitrification in Hamilton Harbour,
Logging Impacts and Some Mechanisms that	na,	Canada, W85-02070 2H
Determine the Size of Spring and Summer Pop- ulations of Coho Salmon Fry (Oncorhynchus	W85-01924 2A	W 83-02070 2H
kisutch) in Carnation Creek, British Columbia,	SIMPSOM, R. L.	Flux of Reduced Chemical Constituents
W85-01919 5C	Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands,	(Fe(2+), Mn(2+), NH4(+) and CH4) and Sediment Oxygen Demand in Lake Erie,
SEDBERRY, F. C.	W85-01805 5B	W85-02087 2H
Water Resources Data, Alabama, Water Year	SINCLAIR, N. A.	
1982, W85-01939 2E	Effect of Noncoliforms on Coliform Detection	SOENKSEN, P. J.
W83-01939 2E	in Potable Groundwater: Improved Recovery	Water Resources Data, Iowa, Water Year 1982, W85-01931 2E
SEGOVIA, A. V.	with an Anaerobic Membrane Filter Technique, W85-02140 5F	W 63-01931 2E
Erosion and Sedimentation Chronology of Three Watersheds in Maryland,		SOLYMAR, Z. V.
W85-01835 2J	SINTON, L. W. Groundwater Quality Survey of an Unsewered,	Earth Foundation Treatment at Jebba Dam Site,
SEIDLER, R. J.	Semi-Rural Area,	W85-01871 8D
Association of Metal Tolerance with Multiple	W85-01633 5B	SOMASHEKAR, R. K.
Antibiotic Resistance of Bacteria Isolated from	SLACK, L. J.	Trace Metal Concentrations of the Waters of a
Drinking Water, W85-02133 5F	Hydrology of an Abandoned Coal-Mining Area	South Indian River, W85-01751 5B
	near McCurtain, Haskell County, Oklahoma, W85-02041 5B	W 83-01/31
SENARATNE, A. Distribution of Nitrates in the Potable Waters of		SOMERS, L.
Sri Lanka,	SLAGLE, S. E. Water Resources of the Fort Union Coal	Seasonal Study of Methane Oxidation in Lake
W85-02015 5B	Region, East-Central Montana,	Washington, W85-02134 2H
Geochemistry of Well Water and Cardiovascu-	W85-01772 2F	11 03-02134
lar Diseases in Sri Lanka,	SLAYMAKER, O.	SOUTEYRAND, E.
W85-01674 5C		General Strategy for Security in Water Supply, W85-01990 5G
SENGUPTA, S.	ity, W85-02060 6G	11-2-1-1-1
Heavy Metal Migration in Soil-Leachate Sys-		SOUZA, W. R.
tems, W85-01868 5B	SLOAN, W. H. Irrigation of Public Use Areas by Land Applica-	Exploratory Drilling and Aquifer Testing at the Kipahulu District Haleakala National Park
	tion of Combined Industrial and Domestic	Maui, Hawaii,
SETTY, M. G. A. P. Pollution Effects Monitoring With Foraminifers	Waste Effluent, W85-01740 5D	W85.01776 2F
as Indices in the Thana Creek, Bombay Area,		
W85-01671 5C	SLY, P. G.	SPALIK, J. Quantitative Determination of ppb Levels of
SEVERIN, B. F.	Comparison of Sediment Energy-Texture Rela- tionships in Marine and Lacustrine Environ-	
Mixing Effects in UV Disinfection,	ments,	Chromatography,
W85-01659 5D	W85-02058 2J	W85-01747 5A

SPECHLER, R. M.	STEVENSON, L. H.	SUGATT, R. H.
Altitude and Generalized Configuration of the Top of the Floridan Aquifer, St. Johns County,	Transport of Dissolved Organic Carbon through a Major Creek of the North Inlet Ecosystem,	Toxicity of Organic Mixtures Saturated in Water to Daphnia magna. Effect of Compositional
Florida,	W85-01766 2L	Changes,
W85-02050 7C	STEWART, J. W.	W85-01953 5C
SPIERS, V. L.	Hydrogeology and Water Quality of Six Landfill	SUIDAN, M. T.
Water Resources Data, Iowa, Water Year 1982,	Sites in Hillsborough County, Florida,	Mixing Effects in UV Disinfection,
W85-01931 2E	W85-01946 5B	W85-01659 5D
SPIES, R. B.	STOERMER, E. F.	
Hepatic Mixed-Function Oxidases in California	Influence of the St. Marys River Plume on	SULLAVAN, J. N.
Flatfishes are Increased in Contaminated Envi-	Northern Lake Huron Phytoplankton Assem-	Water Resources Data, Kentucky, Water Year 1982,
ronments and by Oil and PCB Ingestion, W85-01894 5A	blages, W85-01756 2H	W85-01923 2E
		1100-01720
SPINAZOLA, J. M. Hydrologic Maps of the High Plains Aquifer,	STOKES, W. R. III Water Resources Data, Georgia, Water Year	SULLIVAN, B. K.
January 1981, Southwestern Kansas,	1982,	Effects of Copper and Cadmium on Growth, Swimming and Predator Avoidance in Euryte-
W85-01930 7C	W85-01938 2E	mora affinis (Copepoda),
SPURRIER, J. D.	STONE, R. B.	W85-01900 5C
Transport of Dissolved Organic Carbon through	Drainage Basins in Duval County, Florida,	
a Major Creek of the North Inlet Ecosystem,	W85-02046 7C	SULLIVAN, C. Y.
W85-01766 2L	CTONED I II	Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plains,
SQUIRES, L.	STONER, J. H. Effects of Acidification on the Ecology of	W85-01952 3F
Chlorine as an Algicide in a Conventional Water	Streams in the Upper Tywi Catchment in West	W 03-01/32
Treatment Plant,	Wales,	SUMNER, D. M.
W85-01749 5F	W85-02116 5C	Water-Level Maps of the Alluvial Aquifer in
SQUIRES, R. R.	STOOPS, C. E. JR.	Northwestern Mississippi, April 1983,
Flood Potential of Fortymile Wash and its Prin-	Oil Spill Focuses Attention on the Problems of a	W85-01944 7C
cipal Southwestern Tributaries, Nevada Test	Man-Made Recreational Lake,	SUNDARESAN, B. B.
Site, Southern Nevada, W85-02037 2E	W85-01650 5B	Status of Research and Development in Water
W 83-02037	STOYE, G.	Supply Systems in India,
Reconnaissance of Surface Water Resources in	Rationalization of Central Planning in Water	W85-01982 3D
the Togiak River Basin, Southwestern Alaska,	Management Through the Introduction of EDP	SUPALLA, R. J.
1980 and 1982, W85-01777 2A	(Rationalizierung der zentralen Planung in der	Water Conservation through Limited Irrigation
	Wasserwirtschaft durch Einsatz der EDV), W85-01879 7C	of Corn and Grain Sorghum in the Great Plains,
STACHEL, B.		W85-01952 3F
Determination of Organohalogenic Acids in Water Samples (Bestimmung Halogenorgan-	STRACK, O. D. L.	CHIPPONI E A
ischer Sauren in Wasserproben),	Three-Dimensional Streamlines in Dupuit- Forchheimer Models.	SUTTON, J. A. Dissolved and Suspended Marcussy Species in
W85-01663 5A	W85-02148 2F	Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal
STACKHOUSE, C.		and Regional Variations,
Evaluation of Electrode Methods for Determin-	STRAND, S. E. Rapid BOD Measurement for Municipal	W85-02091 5B
ing Total Residual Chlorine in Various Water	Wastewater Samples using a Biofilm Electrode,	macama as n
Matrices,	W85-01739 5D	TAGATZ, M. E. Responses of Developing Estuarine Macro-
W85-02123 7B	STRAUBE, B.	benthic Communities to Drilling Muds,
STADELMANN, P.	Forecasting of Water Level and Discharge of	W85-01845 5C
Development of the Condition of the Baldegger-	the Elbe with the Aid of Fuzzy Modelling (Vor-	
see (1900 to 1980) and the Effect of Intralake	hersage von Wasserstand und Durchfluss fur die	TAHA, M.
Procedures (Die Zustandsentwicklung dis Bal- deggersees (1900 bis 1980) und die Auswirkung	Elbe mit Hilfe einer unscharfen Modellierung), W85-01973 2E	Chlorine as an Algicide in a Conventional Water Treatment Plant,
von seeinternen Massnahmen),	W83-01973 ZE	W85-01749 5F
W85-01865 5C	STROM, R. N.	
STALDER, F.	Phosphorus Distribution in Sediments of the	TAMMINEN, T.
Corrosion Behaviour of Cast Iron Pipes.	Delaware River Estuary, W85-01843 2L	Effects of Ammonium Effluents on Planktonic
W85-01994 8G		Primary Production and Decomposition in a Coastal Brackish Water Environment. I. Interre-
STARKEY, J. E.	SUBBA-RAO, R. V.	lations Between Abiotic and Biotic Components
Effect of Low Dissolved Oxygen Concentration	Effect of Substrate Concentration and Organic and Inorganic Compounds on the Occurrence	of the Planktonic Ecosystem,
on Effluent Turbidity,	and Rate of Mineralization and Cometabolism,	W85-01840 5C
W85-01653 5D	W85-02132 5B	TARQUIN, A.
STEINKAMPF, W. C.	SUBRAMANIAM, A. R.	Conventional Water Process Costs Studied,
Origins and Distribution of Saline Ground	Agricultural Droughts at Peddapuram, East Go-	W85-01706 5D
Waters in the Floridan Aquifer in Coastal South-	davari District, Andhra Pradesh,	
west Florida, W85-01778 2K	W85-02126 2I	TAYLOR, K. S.
	Water Balance and Crops in Karnataka,	Growth of Cladophora glomerata in a River Receiving Sewage Effluent.
STEPHANOU, E.	W85-02127 21	W85-01723 5C
Identification of Nonionic Detergents by GC/ CI-MS: I. A Complementary Method or an At-	SUCKLING, D. M.	11 US-01123
tractive Alternative to GC/EI-MS and Other	Organic Wastewater Effects on Benthic Inverte-	TERAOKA, H.
Methods,	brates in the Manawatu River,	Elemental Composition of Suspended Particles
W85-01955 5A	W85-01632 5C	From the Yellow and Yangtze Rivers,
STEPHENSON, R. A.	SUDICKY, E. A.	W85-01703 2J
Comparision of Water Catchment and Storage	Contaminant Transport in Fractured Porous	TERLIZZI, D. E.
Systems in Two Micronesian Atoll Communi-	Media: Analytical Solution for a Two-Member	Effects of the Herbicide Atrazine on an Oyster-
ties: Laura and Nama,	Decay Chain in a Single Fracture,	Food Organism,
W85-02028 6D	W85-02170 5B	W85-01808 5C

TESTA, A. J. Evalution of Hollow Fiber Ultrafiltration as a Pretreatment for Reverse Osmosis Desalination	TSCHAPLINSKI, T. J. Stomatal Control of Water Use Efficiency in Poplar Clones and Hybrids,	VAGA, R. M. Trophic Ecology of Fish Rearing Ponds, W85-01833 2H
of Seawater,	W85-01646 2I	W65-01633
W85-01830 3A	TSUBOTA, H.	VALDES, J. B.
THOMAS, N. A.	Behavior of Organically-Bound Iron in Seawater	Physically Based Flood Frequency Distribution,
Quality-Assurance Data for Routine Water	of Estuaries,	W85-02168 2E
Analysis in the Laboratories of the U.S. Geolog-	W85-01913 2L	VAN CRAENENBROECK, W.
ical Survey for Water-Year 1982, W85-01768 7C	TUINSTRA, L. G. M. TH.	Chlorination of Cooling Waters and Quality of
	Contribution of Leaching of Diazinon, Parath-	Water Resources, W85-02023 5D
THOMAS, R. L.	ion, Tetrachorvinphos and Triazophos from	W 63-02023
Comparison of Sediment Energy-Texture Rela- tionships in Marine and Lacustrine Environ-	Glasshouse Soils to Their Concentrations in Water Courses,	VAN DE VEN, F. H. M.
ments.	W85-01961 5B	Design Inflow Intensity and Design Inflow Pro-
W85-02058 2J		files For Storm Sewers, W85-01692 2E
TIK, C.	TUNGER, H. Results and Experience of the Greiz Water-	W 63-01092 2E
Case Study of Heavy Rain Spell on 13th-25th	Supply District in the Field of Rational Water	VAN DER BURG, A. M. M.
December 1982 over the East Coast of Peninsu-	Use (Ergebnisse und Erfahrungen des Versor-	Contribution of Leaching of Diazinon, Parath-
lar Malaysia and Singapore,	gungsbereichs Greiz bei der rationellen Wasser-	ion, Tetrachorvinphos and Triazophos from Glasshouse Soils to Their Concentrations in
W85-02125 2B	verwendung),	Water Courses,
TIPPIT, R.	W85-01880 3D	W85-01961 5B
Changes in the Naiad Fauna of the Cumberland	TURNER, D. R.	
River below Lake Cumberland in Central Ken-	Statistical Analysis of Estuarine Profiles: II Ap-	VAN ES, F. B.
tucky, W85-01921 6G	plication to Arsenic in the Tamar Estuary (S.W.	Use of a Model to Assess Factors Affecting the Oxygen Balance in the Water of the Dollard,
W83-01921	England), W85-01914 5B	W85-01839 2L
TOBIN, R. S.		
Effect of Chlorination on Antibiotic Resistance	TURNEY, G. L.	VAN GENUCHTEN, M. TH.
Profiles of Sewage-Related Bacteria, W85-02139 5D	Fluoride, Nitrate, and Dissolved-Solids Concen-	Flux-Averaged and Volume-Averaged Concen-
	trations in Ground Waters of Washington, W85-01828 2F	trations in Continuum Approaches to Solute Transport.
TOFFOLO, F.		W85-02153 2F
Groundwater Response under an Electronuclear Plant to a River Flood Wave Analyzed by a	TUTSCH, E.	
Nonlinear Finite Element Model,	Data Bank for Waterworks and Facilities - Goals and Problem-solving Concept (Datenbank	VAN HOOF, F.
W85-02157 2F	Wasserwerke und Anlagen - Aufgaben und Lo-	Ozonation and Activated Carbon Filtration: a Critical Evaluation,
TOTTAND P. I. C.	sungskonzeption),	W85-02019 5F
TOLLAND, E. L. C. Spatial and Temporal Trends in Heavy Metal	W85-01969 5F	
Concentrations in Mussels from Northern Ire-	TWINCH, A. J.	VAN KREIJL, C. F. Formation and Removal of Mutagenic Activity
land Coastal Water,	Vertical Stratification in Sediments from a	During Drinking Water Preparation,
W85-01901 5A	Young Oligotrophic South African Impound-	W85-01728 5F
TOMSON, M. B.	ment: Implications in Phosphorus Cycling,	
Fate of Trace Organics During Rapid Infiltra-	W85-02086 2H	VAN LIERE, L.
tion of Primary Wastewater at Fort Devens,	UHLMANN, D.	Influence of Simulated Groundwater-Movement on the Phosphorus Release from Sediments, as
Massachusetts, W85-01730 5D	Ensuring a High Level of Effectiveness and	Measured in a Continuous Flow System,
W 63-01/30	Intensity of Agricultural and Water-Manage- ment Production in Drinking-Water Catchment	W85-02094 2F
TOPPIN, K. W.	Areas (Sicherung hoher Effektivitat und Intensi-	Below of Coliment Dhambarn and the Infly
Water Resources Data, New Hampshire and Vermont, Water Year 1982,	tat der landwirtschaftlichen und wasserwirts-	Release of Sediment-Phosphorus and the Influ- ence of Algal Growth on This Process,
W85-01933 2E	chaftlichen Produktion in Trinkwasser-Einzugs-	W85-01761 2H
	gebieten),	
TOPPING, R. E.	W85-01883 4D	VAN PAGEE, J. A.
Computer-Assisted Water System Analysis and Design for Charleston, S.C.,	ULIANA, F.	Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-
W85-01907 5F	Groundwater Response under an Electronuclear	ame,
TRASE P. P.	Plant to a River Flood Wave Analyzed by a Nonlinear Finite Element Model,	W85-01764 6G
TRAMA, F. B. Response of Algal Populations to Changes in	W85-02157 2F	VAN WIERINGEN, H. S. J.
Stream Water Quality,		Influence of Rainfall Characteristics on the Pol-
W85-01797 5C	UNAL, A.	lution Emission,
TRAMED E I	Evolving Data Processing Environment For Computational Hydraulics Systems,	W85-01697 2E
TRAMER, E. J. Oil Spill Focuses Attention on the Problems of a	W85-01709 7C	ULANDA ARIGONA C. R.
Man-Made Recreational Lake,	TIBANIO W	VANBLARICOM, G. R. Man-Made Structures on Marine Sediments: Ef-
W85-01650 5B	URANO, K. Adsorption of Surfactants on Sediments,	fects on Adjacent Benthic Communities,
TREVISIOL, Y.	W85-01960 5A	W85-01895 . 6G
Areal Reduction Factors on Short Time and		***************************************
Space Intervals,	URCIKAN, P. Synthetic Design Storm and its Relation to In-	VANDIVER, V. J. Removal of Volatile Organic Pollutants from
W85-01690 2B	tensity-Duration Frequency Curves,	Rapid Streams,
TRIMBEE, A. M.	W85-01679 2B	W85-01738 5B
Phytoplankton Population Dynamics of a Small	USDOWSKI, E.	WARDAGA A W
Reservoir: Effect of Intermittent Mixing on Phy-	Kinetic Factors of CaCO3-Precipitation and the	VARMA, A. K. Distribution and Periodicity of Total, Faecal
toplankton Succession and the Growth of Blue- green Algae,	Partitioning of 12C and 13C. Studies at the Wa-	Coliform Bacteria in an Aquatic Ecosystem,
W85-01916 2H	terfalls of Guterstein and Urach (Schwabische	W85-01675 5B
	Alb) (Kinetische Faktoren der CaCO3-Abschei-	
TSANG, G.	dung und der Fraktionierung von 12C und 13C. Untersuchungen an den Wasserfallen von Guter-	Influence of Physico-Chemical Factors on the Coliform Bacteria in a Closed-Lake Water
Modelling Criteria for Bubble Plumes - A Theo- retical Approach,	stein und Urach (Schwabische Alb)),	System,
W85-01715 8B		W85-01672 2H

VAUX, H. J. JR.

VAUX, H. J. JR. Managing Water Scarcity: An Evaluation of In-	Bottom SedimentsComposition and Fluxes to Overlying Waters,	Geochemistry of Well Water and Cardiovascu- lar Diseases in Sri Lanka,
terregional Transfers,	W85-01814 5B	W85-01674 5C
W85-02145 6F	WAIS, M. T.	WEIBEL, T.
VERHAGEN, J. H. G.	Appropriate Technology to Improve Drinking	Erosion Control at High Altitudes (Erosionsbe-
Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-	Water Quality, W85-02014 5F	kampfung im Hochgebirge), W85-01863 4D
ame,		
W85-01764 6G	WAITE, W. P. Microwave Measurements of Moisture Distribu-	WEIR, G. J. Motion of Two Compressible Fluids with Inter-
VERHOFF, F. H.	tions in the Upper Soil Profile,	face in a Porous Reservoir,
Analysis of Total Phosphorus Transport in	W85-02160 2G	W85-02154 2F
River Systems, W85-02074 2E	WALKER, D.	WELDER, G. E.
	Selected Bibliography of Water Resources Pub-	Data for Ground-Water Studies of the San Juan
VERNET, J. P. Basic Concepts and Associated Statistical Meth-	lications for Mississippi, W85-02033 10C	Basin, New Mexico (1982-83), W85-02034 7C
odology in the Geochemical Study of Lake	WALLWORK, J. F.	
Sediments, W85-02064 2J	Automated Sensor Systems for Water Resource	WELLERSHAUS, S. River Elbe: Processes Affecting the Behaviour
	Pollution Warning and Treatment Process Con-	of Metals and Organochlorines During Estuarine
Climatic and Anthropogenic Effects on the Sedi- mentation and Geochemistry of Lakes Bourget,	trol, W85-02010 5F	Mixing,
Annecy and Leman,		W85-01836 5B
W85-02102 2H	WANG, YS. Effect of Substrate Concentration and Organic	WENG, LD.
Manganese Cycle in Lac Leman, Switzerland:	and Inorganic Compounds on the Occurrence	Chemical Derivatization Analysis of Pesticide Residues. VIII. Analysis of 15 Chlorophenols in
The Role of Metallogenium,	and Rate of Mineralization and Cometabolism,	Natural Water by In Situ Acetylation,
W85-02081 2H	W85-02132 5B	W85-02113 5A
VERSACE, P.	WARD, C. H.	WENZEL, H. G. JR.
Two-Component Extreme Value Distribution for Flood Frequency Analysis,	Fate of Trace Organics During Rapid Infiltra- tion of Primary Wastewater at Fort Devens,	Evaluation of Urban Design Storm Sensitivity,
W85-02151 2E	Massachusetts,	W85-01693 2B
VICKERS, T. J.	W85-01730 5D	WERNECKE, R.
Determination of Phenols in Water Using	WASSMANN, P.	Execution of Socialist Business Management in the Continuation of the Colbitz Movement (Die
Raman Spectroscopy, W85-02114 5A	Sedimentation of Organic and Inorganic Particu-	Durchsetzing der sozialistischen Betriebswirts-
	late Material in Lindaspollene, a Stratified, Land-Locked Fjord in Western Norway,	chaft in Fortfuhrung der Colbitzer Bewegung),
VIEHBECK, A. Investigation of Photocatalytic Oxidation for	W85-01767 2L	W85-01876 5F
Wastewater Cleanup and Reuse,	WATKINS, C. H.	WERUSCHEK, H.
W85-01813 5D	Toxicity of Chlorine to a Common Vascular	Data Bank for Waterworks and Facilities - Goals and Problem-solving Concept (Datenbank
VITT, D. H.	Aquatic Plant, W85-01731 5C	Wasserwerke und Anlagen - Aufgaben und Lo-
Vegetation and Water Chemistry of Four Oligo-		sungskonzeption), W85-01969 5F
trophic Basin Mires in Northwestern Ontario, W85-01648 2H	WATKINS, S. A. Effects of Channel Excavation on Water-Quality	W 65-01969
VOGEL, J. L.	Characteristics of the Black River and on	WHARFE, J. R. Growth of Cladophora glomerata in a River
Potential Urban Rainfall Prediction Measure-	Ground-Water Levels near Dunn, North Caroli-	Receiving Sewage Effluent,
ment System,	na, W85-01924 2A	W85-01723 5C
W85-01701 2B		WHEATON, F. W.
VOIGTLANDER, G.	WATTS, D. G. Water Conservation through Limited Irrigation	Blue Crab Processing Plant Effluent Treatment,
Intensification of Wastewater and Sludge Treat- ment Processes Through Utilization of the	of Corn and Grain Sorghum in the Great Plains,	W85-01741 5D
Energy Potential of Wastewater (Intensivierung	W85-01952 3F	WHITBY, G. E.
der Abwasser-und Schlammbehandlingsprozesse	WEBER, H.	Ultraviolet Disinfection of Secondary Effluent, W85-01654 5D
durch nutzung des Eigenenergiepotenitals der Abwasser),	Analysis of Quantitative Wastewater Measure-	
W85-01970 5D	ments of a Country Restaurant Situated at Ap- proximately 1080 m Altitude and of a Mountain	WHITEHEAD, P. G. Modeling Algal Behaviour in the River Thames
VON GUERARD, P.	Inn Situated at Approximately 1410 m Altitude	W85-01720 5G
Sediment Transport in the Lower Yampa River,	(Auswertung von Schmutzwasser-Mengenmes- sungen bei einem Ausflugsrestaurant, rund 1080	WHITEMAN, K. L.
Northwestern Colorado, W85-02045 2J	m u. M. und bei einem Berggasthof, rund 1410 m	Occurrence, Quality, and Use of Ground Water
	u. M.), W85-01854 5D	in Orcas, San Juan, Lopez, and Shaw Islands
VOORHEES, M. L. Evaluation of Urban Design Storm Sensitivity,		San Juan County, Washington, W85-02043 70
W85-01693 2B	WEBER, R. Pumps for Liquids, Especially for Wastewater	WHITESIDES, D, V.
VOUTSINOU-TALIADOURI, F.	(Pumpen fur Flussigkeiten, insbesondere fur Ab-	Water Resources Data, Kentucky, Water Year
Mytilus galloprovincialis and Parapenaeus lon-	Wasser),	1982,
girostris as Bioindicators of Heavy Metal and Organochlorine Pollution,	W85-01864 8C	W85-01923 2E
W85-01899 5A	WEBER, W. J. JR.	WHITFIELD, M.
VUKMIROVIC, V. D.	Use of Fixed-Bed Adsorber Models to Predict the Fluxes of Toxic Substances in Groundwaters	Statistical Analysis of Estuarine Profiles: II Application to Arsenic in the Tamar Estuary (S.W.
Statistical Methods of Storm Analysis,	and Soil Environments,	England),
W85-01680 2B	W85-01793 5B	W85-01914 51
WAGEL, D. J.	WEERASOORIYA, S. V. R.	WHITMAN, R. L.
Chemical Study of the Interstitial Water Dis- solved Organic Matter and Gases in Lake Erie,	Distribution of Nitrates in the Potable Waters of Sri Lanka,	Availability of Dissolved Oxygen in Interstitis Waters of a Sandy Creek,
Cleveland Harbor, and Hamilton Harbour	W85-02015 5B	W85-02103 21

WHITMORE, T. J.	WONG, M. H.	YOUNG, R. L.
Deepwater Sediments and Trophic Conditions in Florida Lakes.	Heavy Metals in Ulva lactuca Collected within Tolo Harbour, An Almost Landlocked Sea,	Flood Potential of Fortymile Wash and its Principal Southwestern Tributaries, Nevada Test
W85-02099 2H	W85-01762 5B	Site, Southern Nevada,
WIEGLEB, G.	WOODING, R. A.	W85-02037 2E
Study of Habitat Conditions of the Macrophytic Vegetation in Selected River Systems in West-	Motion of Two Compressible Fluids with Inter- face in a Porous Reservoir,	YOUNG, T. C.
ern Lower Saxony (Federal Republic of Germa-	W85-02154 2F	Algal-Availability of Particulate Phosphorus
ny), W85-01887 2H	WOYCHUK, R. N.	from Diffuse and Point Sources in the Lower Great Lakes Basin.
WIEGLEB, K.	Dissolved and Suspended Mercury Species in	W85-02061 2K
Observations from the Test Operation of an Ion-	the Wabigoon River (Ontario, Canada): Seasonal and Regional Variations,	ZACHOS, L. G.
exchange Facility for Nitrate Removal in Drink- ing-water Treatment (Erfahrungen aus dem Er-	W85-02091 5B	Classification and Description of Dolomitic Fab-
probengsbetrieb einer Ionenaustauscheranlage	WYRWICH, M.	rics of Rocks from the Floridan Aquifer, U.S.A.,
zur Nitratelimination in der Trinkwasseraufber- eitung),	Improved Operational Control of Sedimentation Facilities Through the Use of Fiberoptic Sensors	W85-01733 2F
W85-01974 5F	(Verbesserte Betriebskontrolle von Sedimenta-	ZEMLIN, R.
WILKES, D. R. Flocculation Model Testing: Particle Sizes in a	tionsanlagen durch Nutzung faseroptischer Sen- soren).	Intensification of Wastewater and Sludge Treat- ment Processes Through Utilization of the
Softening Plant,	W85-01882 5D	Energy Potential of Wastewater (Intensivierung
W85-01908 5F	XIE, T. M.	der Abwasser-und Schlammbehandlingsprozesse durch nutzung des Eigenenergiepotenitals der
WILLIAMS, L. R. Earth Foundation Treatment at Jebba Dam Site,	Simultaneous Determination of Partition Coeffi- cients and Acidity Constants of Chlorinated	Abwasser),
W85-01871 8D	Phenols and Guaiacols by Gas Chromatography,	W85-01970 5D
WILLIAMS, R. T.	W85-02115 5A	ZESCHMAR, B.
Methane Production in Minnesota Peatlands, W85-02135 2L	YAKSICH, S. M. Analysis of Total Phosphorus Transport in	Determination of Organohalogenic Acids is Water Samples (Bestimmung Halogenorgan
WILLIAMS, T. M.	River Systems, W85-02074 2E	ischer Sauren in Wasserproben), W85-01663 5/
Sediment Concentrations from Intensively Pre- pared Wetland Sites,	YANG, TS.	W 63-01003
W85-02112 4C	Elemental Composition of Suspended Particles	ZHONG, W. Z.
WILLIAMSON, R. B. Water Quality of the Waiohewa Stream, Ro-	From the Yellow and Yangtze Rivers, W85-01703 2J	Quantitative Determination of ppb Levels of Carbamate Pesticide in Water by Capillary Ga Chromatography,
torua, W85-01634 5B	YEH, W. WG.	W85-01747 5/
WILSON, B. L.	Parameter Identification of Groundwater Aqui- fer Models: A Generalized Least Squares Ap-	TRANSPORTED FOR
Analysis of Aqueous Sediments for Heavy	proach,	ZIMMERMAN, D. E. Hydrogeochemical Investigation of Therms
Metals, W85-01742 5B	W85-02164 2F	Springs in the Black Canyon-Hoover Dam Area Nevada and Arizona,
WILSON, J. T.	YEVJEVICH, V. Estimation of Skewness of Hydrologic Varia-	W85-01804 21
Fate of Trace Organics During Rapid Infiltra- tion of Primary Wastewater at Fort Devens,	bles,	
Massachusetts,	W85-02161 2A	ZSCHUPPE, K. H. Standardization of Methods of Analysis for
W85-01730 5D	YOBBI, D. K.	Heavy Metals in Sediments,
WONG, G. T. F. Recent Vertical Accretion Rates at Blackwater	Trends and Fluctuations in the Potentiometric Surface of the Floridan Aquifer, West-Central	W85-02104 5/
Wildlife Refuge,	Florida, 1961-80,	ZYTARUK, B. G.
W85-01809 2L	W85-01940 7C	Distribution and Concentrations of Naturally
WONG, K. V.	YOSHIDA, T. Summer Peak of Nutrient Concentrations in	Occurring Radionuclides in Sediments in a Unnium Mining Area of Northern Saskatchewa
Heavy Metal Migration in Soil-Leachate Sys- tems,	Lake Water,	Canada,
W85-01868 5B	W85-02098 5B	W85-02083 5



AARHUS UNIV. (DENMARK), INST. OF HYGIENE.	ANTWERPSE WATERWERKEN (BELGIUM), Chlorination of Cooling Waters and Quality of	BENEDICT COLL., COLUMBIA, SC. DEPT. OF CHEMISTRY.
Bacteria in Works and Mains from Ground	Water Resources,	Evaluation of Electrode Methods for Determin-
Water Supplies, W85-02001 5F	W85-02023 5D	ing Total Residual Chlorine in Various Water
	ARIZONA UNIV., TUCSON, DEPT. OF	Matrices, W85-02123 7B
ABO AKADEMI, TURKU (FINLAND). LAB.	MICROBIOLOGY AND IMMUNOLOGY.	
OF FOREST PRODUCTS CHEMISTRY. Method for Total Organic Chlorine Determina-	Effect of Noncoliforms on Coliform Detection in Potable Groundwater: Improved Recovery	BERGEN UNIV. (NORWAY). INST. OF
tion in Bleach Plant Recipient Waters,	with an Anaerobic Membrane Filter Technique,	MARINE BIOLOGY.
W85-01962 5A	W85-02140 5F	Sedimentation of Organic and Inorganic Particu- late Material in Lindaspollene, a Stratified, Land-Locked Fjord in Western Norway,
AGRICULTURAL RESEARCH SERVICE,	ARIZONA UNIV., TUCSON. DEPT. OF	W85-01767 2L
BELTSVILLE, MD. HYDROLOGY LAB. Statistical Methods of Storm Analysis,	PLANT SCIENCES.	
W85-01680 2B	Yield and Quality of Cotton Grown with Wastewater,	BERNISCHE KRAFTWERKE A.G.
	W85-01869 5D	(SWITZERLAND). Rebuilding of the Hydro-Electric Power Station
AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS), DEPT, OF HYDRAULICS		of Spiez (Kraftwerk Spiez Erneuerung 1982-
AND CATCHMENT HYDROLOGY.	ARKANSAS UNIV., FAYETTEVILLE, DEPT. OF AGRONOMY.	1985),
Wind Induced Diffusion in a Shallow Lake, A	Microwave Measurements of Moisture Distribu-	W85-01857 8A
Case Study, W85-01763 2H	tions in the Upper Soil Profile,	BHABHA ATOMIC RESEARCH CENTRE.
	W85-02160 2G	BOMBAY (INDIA). AIR MONITORING
ALBERTA ENVIRONMENT, EDMONTON. WATER RESOURCES MANGEMENT DIV.	ARKANSAS UNIV., FAYETTEVILLE. WATER	SECTION. Some Observations on the Chemical Composi-
Spatial Heterogeneity in Whole Lake Sediments	RESOURCES RESEARCH CENTER. Disposal of Household Wastewater in Soils of	tion of Precipitation in an Industrial Area and
- Towards a Loading Estimate,	High Stone Content (1981-1983),	It's Use in Air Quality Assessment,
W85-02073 2H	W85-01815 5D	W85-02129 5B
ALBERTA ENVIRONMENTAL CENTRE,	A DAZU PAGIATEEN WATERWAYE	BIESBOSCH WATER STORAGE CORP.
VEGREVILLE.	ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.	(NETHERLANDS).
Pesticide and PCB Levels in Fish from Alberta (Canada).	Changes in the Naiad Fauna of the Cumberland	Quality Aspects of the Biesbosch Reservoirs,
(Canada). W85-01954 5A	River below Lake Cumberland in Central Ken-	W85-01979 5G
	tucky, W85-01921 6G	BIOLOGISCH CENTRUM, HAREN
ALBERTA UNIV., EDMONTON. DEPT. OF	W 63-01921	(NETHERLANDS).
BOTANY. Vegetation and Water Chemistry of Four Oligo-	ARMY ENGINEER WATERWAYS	Use of a Model to Assess Factors Affecting the
trophic Basin Mires in Northwestern Ontario,	EXPERIMENT STATION, VICKSBURG, MS.	Oxygen Balance in the Water of the Dollard,
W85-01648 2H	ENVIRONMENTAL LAB. Role of Sediments in the Nitrogen Budget of	W85-01839 2L
ALBERTA UNIV., EDMONTON, DEPT. OF	Lower Green Bay, Lake Michigan,	BIRMINGHAM UNIV. (ENGLAND), DEPT. OF
CIVIL ENGINEERING.	W85-01754 5B	CIVIL ENGINEERING.
Microorganism Survival in an Ice-Covered	ARMY MEDICAL BIOENGINEERING	Effects of Baffles on the Performance of Model
River, W85-01708 5B	RESEARCH AND DEVELOPMENT LAB.,	Waste Stabilization Ponds, W85-01719 5D
W 65-01706	FORT DETRICK, MD.	
AMERICAN UNIV., BEIRUT (LEBANON).	Microbial Degradation of 2,4,6-Trichloroaniline	BREMEN UNIV. (GERMANY, F.R.).
DEPT. OF ENVIRONMENTAL HEALTH.	in Aquatic Samples and Laboratory Enrichment Cultures,	FACHBEREICH CHEMIE/BIOLOGIE.
Change in Quality of Thermal Groundwater From a Unique Resource in Lebanon,	W85-02120 5B	Determination of Organohalogenic Acids in Water Samples (Bestimmung Halogenorgan-
W85-01673 2F		ischer Sauren in Wasserproben),
att 1	AUBURN UNIV., AL. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.	W85-01663 5A
Chlorine as an Algicide in a Conventional Water Treatment Plant,	Effect of Treatment with a Commercial Bacte-	BRITISH COLUMBIA UNIV., VANCOUVER.
W85-01749 5F	rial Suspension on Water Quality in Channel	DEPT. OF CIVIL ENGINEERING.
	Catfish Ponds,	Aerobic Sludge Digestion with pH Control -
AMSTERDAM UNIV. (NETHERLANDS), LAB. VOOR MICROBIOLOGIE.	W85-01922 5F	Preliminary Investigation,
Release of Sediment-Phosphorus and the Influ-	BAIRD (W.F.) AND ASSOCIATES, OTTAWA	W85-01660 5D
ence of Algal Growth on This Process,	(ONTARIO).	BRITISH COLUMBIA UNIV., VANCOUVER.
W85-01761 2H	Design of Armour Systems for the Protection of Rubble Mound Breakwaters,	DEPT. OF GEOGRAPHY.
Influence of Simulated Groundwater-Movement	W85-01707 2J	Land Use Effects on Sediment Yield and Qual-
on the Phosphorus Release from Sediments, as		ity, W85-02060 6G
Measured in a Continuous Flow System,	BAYREUTH UNIV. (GERMANY, F.R.).	W 85-02000
W85-02094 2F	LEHRSTUHL FUER HYDROLOGIE. Behaviour of Polycyclic Aromatic Hydrocar-	BRITISH COLUMBIA UNIV., VANCOUVER.
ANATEL INSTRUMENT CORP., BOULDER,	bons in the Exe Estuary, Devon,	INST. OF ANIMAL RESOURCE ECOLOGY.
CO.	W85-01841 5B	Commentary on Environmental Impact Assess- ment for Large Projects Affecting Lakes and
State-of-the-Art for Electronic Grade Ultrapure Water Manufacturing and Distribution, Part I,	BEAK CONSULTANTS LTD., MISSISSAUGA	Streams,
W85-01873 5F	(ONTARIO).	W85-01920 6G
	Model for Instream Regulation of Radioisotopes	PROUNT BOVERT LINE CUE A CL BARRES
ANDHRA UNIV., WALTAIR (INDIA), DEPT. OF METEOROLOGY AND	and Heavy Metals in Riverine Waters Subjected to a Uranium Mill Discharge,	BROWN, BOVERI UND CIE A.G., BADEN (SWITZERLAND).
OCEANOGRAPHY,	W85-02068 5B	Asynchronous Generator; An Alternative to the
Agricultural Droughts at Peddapuram, East Go-		Synchronous Generator for Small Hydroelectric
davari District, Andhra Pradesh,	BELGRADE UNIV. (YUGOSLAVIA).	Power Stations with Output up to 20,000 kW (Der Asynchrongenerator; Eine Alternative zum
W85-02126 2I	FACULTY OF CIVIL ENGINEERING. Some Statistical Properties of Short-Duration	Synchrongenerator fur kleine Wasserkraftanla-
Water Balance and Crops in Karnataka,	Rainfall,	gen mit einer Leistung bis 20000 kW),
W85-02127 2I	W85-01681 2B	W85-01858 8C

BUERO FUER LANDSCHAFTSPLANUNG, USTER (SWITZERLAND).

BUERO FUER LANDSCHAFTSPLANUNG, USTER (SWITZERLAND).	Effects of Runoff from Undeveloped Versus Lightly Developed Watersheds on Tropical	COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Erosion Control at High Altitudes (Erosionsbe-	Planktonic Ecosystem,	Real Time Irrigation Scheduling via 'Reaching'
kampfung im Hochgebirge), W85-01863 4D	W85-01810 5C	Dynamic Programming, W85-02155 3F
DETROATE DESCRIPTING CONCERTS	CENTRAL LAB. OF MEKOROT (ISRAEL).	
BUREAU D'INGENIEURS-CONSEILS, LAUSANNE (SWITZERLAND).	Transport Phenomena New Experimental Re- sults in Hydrodynamical 'Forced Rayleigh Scat-	COLUMBIA NATIONAL FISHERIES RESEARCH LAB., MO.
Tasks of the Dam Keeper (Les Taches du Gar-	tering' (Phenomenes de Transport Nouveaux	Bioavailability of Pb and Zn from Mine Tailings
dien de Barrage), W85-01859 4A	resultats experimentaux en diffusion 'Rayleigh forcee' hydrodynamic),	as Indicated by Erythrocyte delta-Aminolevu- linic Acid Dehydratase (ALA-D) Activity in
CAIRO UNIV., GIZA (EGYPT). DEPT. OF	W85-01745 1A	Suckers (Pisces: Catostomidae),
RRIGATION AND HYDRAULICS.	CENTRE D'ECOLOGIE DE CAMARGUE	W85-01918 5A
Irrigated Agricultural Expansion Planning in Developing Countries: Investment Scheduling	(FRANCE).	COLUMBIA UNIV., NEW YORK. DEPT. OF
Incorporating Drainage Water Reuse, W85-02142 3F	Geochemistry of the Rhine and the Rhone and Human Impact (La Geochimie du Rhin et du	CIVIL ENGINEERING, Darcy's Flow with Variable Permeability: A
W 63-02142 SI	Rhone et L'impact Humain),	Boundary Integral Solution,
Irrigated Agricultural Expansion Planning in Developing Countries: Income Redistribution	W85-02059 2H	W85-02165 2F
Objective, W85-02143 3F	Loading Concentration Models for Phosphate in Shallow Lakes,	COMMISSION OF THE EUROPEAN COMMUNITIES, BRUSSELS (BELGIUM).
Irrigated Agricultural Expansion Planning in	W85-02067 2H	Water Decade (La Decennie de l'Eau),
Developing Countries: Resilient System Design,	CENTRE NATIONAL DE LA RECHERCHE	W85-01984 6B
W85-02144 6A	SCIENTIFIQUE, PARIS (FRANCE). Heavy Metals in the Lower Mississippi River,	COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY), JOINT
CALIFORNIA UNIV., DAVIS, DEPT. OF	W85-01744 5B	RESEARCH CENTRE.
LAND, AIR AND WATER RESOURCES. Developing the Resource Potential of a Shallow		Sedimentation Rates in a Swiss-Italian Lake
Water Table,	CENTRE UNIV. DE LUMINY, MARSEILLE (FRANCE). LAB. D'HYDROBIOLOGIE	Measured with Sediment Traps, W85-02100 2J
W85-01832 3B	MARINE.	
CALIFORNIA UNIV., LOS ANGELES.	Impact of Domestic Sewage Pollution on Enzy- matic Activities of Two Planktonic Copepods	COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION.
SCHOOL OF ENGINEERING AND APPLIED SCIENCE.	(Acartia clausi and Centropages typicus)	CANBERRA (AUSTRALIA), DIV. OF
Parameter Identification of Groundwater Aqui-	(Impact d'une Pollution d'Origine Urbaine sur	ENVIRONMENTAL MECHANICS.
fer Models: A Generalized Least Squares Ap- proach,	les Activites Enzymatiques de deux Copepodes Planctoniques (Acartia Clausi et Centropages ty-	Travel Times from Buried and Surface Infiltra- tion Point Sources,
W85-02164 2F	picus)),	W85-02167 2G
CALIDODANA DANY BEVERGINE DERF OF	W85-01898 5C	
CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.	CH2M HILL, MONTGOMERY, AL.	COMPAGNIE GENERALE DES EAUX, PARIS (FRANCE).
Managing Water Scarcity: An Evaluation of In-	Computer-Assisted Water System Analysis and	Study of Mutagenic Activity in Water in a Pro-
terregional Transfers, W85-02145 6F	Design for Charleston, S.C., W85-01907 5F	gressive Ozonation Unit (Etude du Caractere Mutagene de l'Eau dans une Filiere de Produc-
CALIFORNIA UNIV., SANTA BARBARA.	CHALMERS UNIV. OF TECHNOLOGY,	tion a Ozonation Estagee), W85-01987 5F
DEPT. OF MECHANICAL AND ENVIRONMENTAL ENGINEERING.	GOETEBORG (SWEDEN), DEPT. OF ANALYTICAL AND MARINE CHEMISTRY,	
Entrainment, Deposition, and Transport of Fine-	Simultaneous Determination of Partition Coeffi-	Nice on the French Riviera - the Birthplace of Drinking Water Treatment with Ozone (Nice,
Grained Sediments in Lakes, W85-02055 2J	cients and Acidity Constants of Chlorinated	sur la Riviera Francaise - Berceau du Traitement
	Phenols and Guaiacols by Gas Chromatography, W85-02115 5A	de l'Eau par l'Ozone), W85-01988 5F
CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).	37	74 03-01700
Aquatic Leeches (Hirudinea) as Bioindicators of	CHINESE UNIV. OF HONG KONG, SHATIN.	General Strategy for Security in Water Supply,
Organic Chemical Contaminants in Freshwater Ecosystems,	DEPT. OF BIOLOGY. Heavy Metals in Ulva lactuca Collected within	W85-01990 5G
W85-01958 5A	Tolo Harbour, An Almost Landlocked Sea,	Towards Total Automation of Water Distribu-
Comparison of Sediment Energy-Texture Rela-	W85-01762 5B	tion (Vers l'Automatisation Integrale dans la Distribution d'Eau).
tionships in Marine and Lacustrine Environ-	CLARKSON COLL. OF TECHNOLOGY,	W85-02009 6A
ments, W85-02058 2J	POTSDAM, NY. DEPT. OF CIVIL AND	2001 Th. T
W 05-02030	ENVIRONMENTAL ENGINEERING. Algal-Availability of Particulate Phosphorus	2001 The Future of Water Treatment (2001 L'Avenir du Traitement de l'Eau),
Mass Balance Models of Phosphorus in Sedi-	from Diffuse and Point Sources in the Lower	W85-02017 6A
ments and Water, W85-02071 2J	Great Lakes Basin, W85-02061 2K	COOKE (J. BARRY), INC., SAN RAFAEL, CA.
	W 03-02001	Progress in Rockfill Dams,
Chemical Derivatization Analysis of Pesticide Residues. VIII. Analysis of 15 Chlorophenols in	CLEMSON UNIV., SC. BELLE W. BARUCH	W85-01870 8A
Natural Water by In Situ Acetylation,	FOREST SCIENCE INST. Sediment Concentrations from Intensively Pre-	COPENHAGEN UNIV., HILLEROED
W85-02113 5A	pared Wetland Sites,	(DENMARK), DET FERSKVANDS-
CANVIRO CONSULTANTS LTD.,	W85-02112 4C	BIOLOGISKE LAB.
KITCHENER (ONTARIO), Two-Stage Biological Fluidized Bed Treatment	CLEMSON UNIV., SC. DEPT. OF FORESTRY.	Diurnal Variation in the Oxygen Uptake of River Sediments in Vitro by Use of Continuous
of Coke Plant Wastewater for Nitrogen Control,	Waterlogging Tolerance of Lowland Tree Spe-	Flow-Through Systems,
W85-01655 5D	cies of the South, W85-02111 2I	W85-02069 2E
CARIBBEAN RESEARCH INST., ST.		CORNELL UNIV., ITHACA, NY. DEPT. OF
THOMAS, VI.	COLD REGIONS RESEARCH AND	CITY AND REGIONAL PLANNING.
Land Use, Runoff and Recharge on Selected Watersheds in the U.S. Virgin Islands,	ENGINEERING LAB., HANOVER, NH. Ice Cover Melting in a Shallow River,	Major Institutional Arrangements Affecting Ground Water in New York State.
W85-01799 4C	W85-01713 2C	W85-01802 6E

CORNELL UNIV., ITHACA, NY. LAB. OF	DUKE UNIV., DURHAM, NC. DEPT. OF	FLORIDA STATE UNIV., TALLAHASSEE.
SOIL MICROBIOLOGY.	CIVIL AND ENVIRONMENTAL	DEPT. OF CHEMISTRY.
Effect of Substrate Concentration and Organic	ENGINEERING.	Determination of Phenols in Water Using
and Inorganic Compounds on the Occurrence	Integrated Methodology for Instream Flow	Raman Spectroscopy,
and Rate of Mineralization and Cometabolism, W85-02132 5B	Strategies,	W85-02114 5A
W 65-02132 3D	W85-01951 5B	
DALTON-DALTON-NEWPORT, INC.,	DUNSTAFFNAGE MARINE RESEARCH LAB.,	FLORIDA STATE UNIV., TALLAHASSEE, DEPT. OF OCEANOGRAPHY.
CLEVELAND, OH.	OBAN (SCOTLAND),	Modeling Estuarine Nutrient Geochemistry in a
Preliminary Findings of the Priority Pollutant	Environmental and Biochemical Investigation of	Simple System,
Monitoring Project of the Nationwide Urban Runoff Program,	Some Effects of Organic Pollution in Inner Os-	W85-01702 2L
W85-01661 5A	lofjord, Norway,	
	W85-01896 5C	FLORIDA UNIV., GAINESVILLE, DEPT. OF
DE PAUL UNIV., CHICAGO, IL.	DURHAM UNIV. (ENGLAND),	ENVIRONMENTAL ENGINEERING
Net Atmospheric Inputs of PCBs to the Ice	MINES: A Model to Forecast Mine Wastewater	SCIENCES.
Cover on Lake Huron, W85-01759 5B	Quality,	Determination of Aldicarb and its Derivatives in
W05-01755	W85-01750 5B	Groundwaters by High-Performance Liquid Chromatography with UV Detection.
DELAWARE UNIV., NEWARK. DEPT. OF		W85-01748 5A
GEOLOGY.	ECOLOGICAL RESEARCH ASSOCIATES,	W 63-01746
Phosphorus Distribution in Sediments of the	DAVIS, CA. Use of Artifical Wetlands to Remove Nitrogen	FLORIDA UNIV., GAINESVILLE, DEPT. OF
Delaware River Estuary, W85-01843 2L	Compounds from Wastewater,	GEOGRAPHY.
***************************************	W85-01978 5D	Drought in Southeastern United States,
DENVER WATER DEPT., CO.		W85-01642 2B
Calibrating Water System Models,	EDINBURGH UNIV. (SCOTLAND). DEPT. OF	
W85-01904 5F	CHEMISTRY.	FLORIDA UNIV., GAINESVILLE, DEPT. OF
DEPARTMENT OF FISHERIES AND	Mechanisms of Metal Adsorption from Aqueous	GEOLOGY.
OCEANS, NANAIMO (BRITISH COLUMBIA).	Solutions by Waste Tyre Rubber, W85-01724 5D	Classification and Description of Dolomitic Fab-
PACIFIC BIOLOGICAL STATION.	W63-01724	rics of Rocks from the Floridan Aquifer, U.S.A.,
Logging Impacts and Some Mechanisms that	EIDGENOESSISCHE ANSTALT FUER	W85-01733 2F
Determine the Size of Spring and Summer Pop-	WASSERVERSORGUNG,	FRESHWATER BIOLOGICAL ASSOCIATION,
ulations of Coho Salmon Fry (Oncorhynchus kisutch) in Carnation Creek, British Columbia,	ABWASSERREINIGUNG UND	WAREHAM (ENGLAND), RIVER LAB.
W85-01919 5C	GEWAESSERSCHULTZ, DUEBENDORF	Influence of Within-Stream Disturbance on Dis-
	(SWITZERLAND).	solved Nutrient Levels During Spates,
DEPARTMENT OF FISHERIES AND	Analysis of Quantitative Wastewater Measure-	W85-02089 2E
OCEANS, WINNIPEG (MANITOBA).	ments of a Country Restaurant Situated at Ap- proximately 1080 m Altitude and of a Mountain	
FRESHWATER INST.	Inn Situated at Approximately 1410 m Altitude	FRESHWATER BIOLOGICAL ASSOCIATION,
Dissolved and Suspended Mercury Species in the Wabigoon River (Ontario, Canada): Seasonal	(Auswertung von Schmutzwasser-Mengenmes-	WINDERMERE (ENGLAND).
and Regional Variations,	sungen bei einem Ausflugsrestaurant, rund 1080	Transport of Iron and Manganese in Relation to
W85-02091 5B	m u. M. und bei einem Berggasthof, rund 1410 m	the Shapes of Their Concentration-Depth Pro-
	u. M.),	files, W85-02090 2K
DEPARTMENT OF SCIENTIFIC AND	W85-01854 5D	W85-02090 2K
INDUSTRIAL RESEARCH, WELLINGTON		GENEVA UNIV. (SWITZERLAND), DEPT, OF
(NEW ZEALAND). APPLIED MATHEMATICS DIV.	Singlet Oxygen in Surface Waters - Part I: Fur-	INORGANIC, ANALYTICAL AND APPLIED
Motion of Two Compressible Fluids with Inter-	furyl Alcohol as a Trapping Agent, W85-01964 2K	CHEMISTRY.
face in a Porous Reservoir,	W 63-01704	Interaction Between Interstitial Water and Sedi-
W85-02154 2F	Singlet Oxygen in Surface Waters - Part II:	ment in Two Cores of Lac Leman, Switzerland,
DED A DELEGATE OF OCCUPANISHES AND	Quantum Yields of Its Production by Some Nat-	W85-02084 2H
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, WELLINGTON	ural Humic Materials as a Function of Wave-	
(NEW ZEALAND). OCEANOGRAPHIC INST.	length,	GENEVA UNIV. (SWITZERLAND), INST. FA.
Water Temperature and Turbidity in Glacially	W85-01965 2K	FOREL.
Fed Lake Tekapo,	ELECTRONIANI DACEL (CHETTERI AND)	Basic Concepts and Associated Statistical Meth-
W85-01637 2H	ELECTROPLAN, BASEL (SWITZERLAND). Hydroelectric Power Station at the Netstal Lime	odology in the Geochemical Study of Lake Sediments,
Predominant Headwater Inflow and its Control	Factory (Das Wasserkraftwerk der Kalkfabrik	W85-02064 2J
of Lake-River Interactions in Lake Wakatipu,	Netstal AG),	W 63-02004
W85-01638 2H	W85-01866 8A	Manganese Cycle in Lac Leman, Switzerland:
		The Role of Metallogenium,
DEUTSCHER VEREIN DES GAS- UND	ELECTROWATT ENGINEERING SERVICES	W85-02081 2H
WASSERFACHES E.V., ESCHBORN	LTD., ZURICH (SWITZERLAND).	
(GERMANY, F.R.). Water Supply in the Federal Republic of Ger-	Construction of the Alicura Hydroelectric Facil-	Climatic and Anthropogenic Effects on the Sedi-
many,	ity in Argentina (Der Bau der Wasserkraftanlage Alicura in Argentinien),	mentation and Geochemistry of Lakes Bourget,
W85-02002 6D	W85-01862 8A	Annecy and Leman,
	***************************************	W85-02102 2H
DHV CONSULTING ENGINEERS,	ENVIRONMENTAL RESEARCH LAB., GULF	GEOLOGICAL SURVEY, ALBANY, NY.
AMERSFOORT (NETHERLANDS). Influence of Rainfall Characteristics on the Pol-	BREEZE, FL.	WATER RESOURCES DIV.
lution Emission,	Responses of Developing Estuarine Macro-	Geohydrology of the Meadowbrook Artificial-
W85-01697 2E	benthic Communities to Drilling Muds,	Recharge Project Site in East Meadow, Nassau
	W85-01845 5C	County, New York,
DONOHUE AND ASSOCIATES, INC.,	FLORIDA STATE MUSEUM, GAINESVILLE.	W85-01774 2F
WAUKESHA, WI.	Deepwater Sediments and Trophic Conditions	
Computerized Distribution Records- CADD Paves the Way,	in Florida Lakes,	Altitude of the Top of the Matawan Group-
W85-01902 5F	W85-02099 2H	Magothy Formation, Suffolk Country, Long
		Island, New York, W85-02030 7B
DOW CHEMICAL CO., MIDLAND, MI.	FLORIDA STATE UNIV., TALLAHASSEE.	W 03-02030 /B
ANALYTICAL LABS.	DEPT. OF BIOLOGICAL SCIENCE. Trophic Response of Fishes to Habitat Variabili-	Data for Ground-Water Studies of the San Juan
Determination of 2,3,7,8-Tetrachlorodibenzo-p- Dioxin in Treated Wastewater,	ty in Coastal Seagrass Systems,	Basin, New Mexico (1982-83),
Wes 01720	Wes 01900 21	W85.02034 7C

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.

Floods of August 7-8, 1979, in Chautauqua County, New York, with Hydraulic Analysis of Canadaway Creek in the Village of Fredonia,	Water Resources Data, Massachusetts and Rhode Island, Water Year 1982, W85-01935 2E	Potential Effects of Surface Coal Mining on the Hydrology of the Corral Creek Area, Hanging Woman Creek Coal Field, Southeastern Mon-
W85-02051 2E	GEOLOGICAL SURVEY, CARSON CITY, NV.	tana, W85-02040 5B
GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.	WATER RESOURCES DIV. Flood Potential of Fortymile Wash and its Prin-	GEOLOGICAL SURVEY, HONOLULU, HI.
Instrumentation Used for Hydraulic Testing of	cipal Southwestern Tributaries, Nevada Test	WATER RESOURCES DIV.
Potential Water-Bearing Formations at the Waste Isolation Pilot Plant Site in Southeastern, New Mexico,	Site, Southern Nevada, W85-02037 2E	Exploratory Drilling and Aquifer Testing at the Kipahulu District Haleakala National Park,
W85-01827 7B	GEOLOGICAL SURVEY, CHEYENNE, WY.	Maui, Hawaii,
Annual Water-Resources Review, White Sands	WATER RESOURCES DIV.	W85-01776 2F
Missile Range, New Mexico, 1982, W85-01927 2E	Computer Program and Data Listing for Two- Dimensional Ground-Water Model for Laramie	GEOLOGICAL SURVEY, HURON, SD. WATER RESOURCES DIV.
	County, Wyoming, W85-01787 7C	Major Aquifers in Miner County, South Dakota,
Estimation of Natural Streamflow in the Jemez River at the Boundaries of Indian Lands, Central		W85-01950 2F
New Mexico, W85-02048 2E	GEOLOGICAL SURVEY, COLUMBIA, SC. WATER RESOURCES DIV.	GEOLOGICAL SURVEY, INDIANAPOLIS, IN.
W 85-02046	Water Resources Data, South Carolina, Water	WATER RESOURCES DIV.
GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.	Year 1982, W85-01937 2E	Shallow Ground-Water Flow and Drainage Characteristics of the Brown Ditch Basin near
Sediment Transport in the Tanana River near		the East Unit, Indiana Dunes National Lake-
Fairbanks, Alaska, 1982, W85-01769 2J	GEOLOGICAL SURVEY, COLUMBUS, OH.	shore, Indiana, 1982, W85-01948 4A
W85-01769 2J	WATER RESOURCES DIV. Ground-Water Hydrology and Quality before	W 63-01946
Reconnaissance of Surface Water Resources in	and after Strip Mining of a Small Watershed in	GEOLOGICAL SURVEY, IOWA CITY, IA.
the Togiak River Basin, Southwestern Alaska, 1980 and 1982,	Jefferson County, Ohio, W85-01943 4C	WATER RESOURCES DIV.
W85-01777 2A	W 85-015-45	Water Resources Data, Iowa, Water Year 1982, W85-01931 2E
Sediment Transport in the Tanana River near	GEOLOGICAL SURVEY, DENVER, CO.	
Fairbanks, Alaska, 1980-81,	WATER RESOURCES DIV. Quality-Assurance Data for Routine Water	GEOLOGICAL SURVEY, JACKSON, MS.
W85-01788 2J	Analysis in the Laboratories of the U.S. Geolog-	WATER RESOURCES DIV. Water-Level Maps of the Alluvial Aquifer,
Activities of the Alaska District, Water Re-	ical Survey for Water-Year 1982,	Northwestern Mississippi, April, 1982,
sources Division, U.S. Geological Survey, 1984. W85-01825 10C	W85-01768 7C True Location and Orientation of Fractures	W85-01926 7C
GEOLOGICAL SURVEY, AUSTIN, TX.	Logged with the Acoustic Televiewer (Includ-	Water-Level Maps of the Alluvial Aquifer in
WATER RESOURCES DIV. Records of Wells, Drillers' Logs, Water-Level	ing Programs to Correct Fracture Orientation), W85-01780 2F	Northwestern Mississippi, April 1983, W85-01944 7C
Measurements, and Chemical Analyses of	Marking Bandakla Data Files from the Madison	Selected Bibliography of Water Resources Pub-
Ground Water in Chambers, Liberty, and Mont- gomery Counties, Texas, 1975-79,	Machine-Readable Data Files from the Madison Limestone and Northern Great Plains Regional	lications for Mississippi,
W85-01818 2F	Aquifer System Analysis Projects, Montana, Ne- braska, North Dakota, South Dakota, and Wyo-	W85-02033 10C
Records of Wells, Drillers' Logs, Water-Level	ming,	Altitude and Generalized Configuration of the Top of the Floridan Aquifer, St. Johns County,
Measurements, and Chemical Analyses of Ground Water in Brazoria, Fort Bend, and	W85-01790 7C	Florida,
Waller Counties, Texas, 1975-79,	Geohydrologic Data for Test Well USW G-4,	W85-02050 7C
W85-01819 2F	Yucca Mountain Area, Nye County, Nevada,	CEOLOGICAL SUBVEY LAVEROOD CO
Water Quality of Lake Arlington on Village Creek, North-Central Texas, 1973 to 1981,	W85-02031 7C GEOLOGICAL SURVEY, DORAVILLE, GA.	GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
W85-02042 2H	WATER RESOURCES DIV.	Generalized Altitude and Configuration of the Water Table in Parts of Larimer, Logan, Sedg-
GEOLOGICAL SURVEY, BATON ROUGE, LA.	Effects of the Drought of 1980-81 on Stream-	wick, and Weld Counties, Colorado,
WATER RESOURCES DIV.	flow and on Ground-water Levels in Georgia, W85-01783	W85-01775 2F
Regional Geohydrology of the Northern Louisi- ana Salt-Dome Basin, Part III, Potentiometric		Daily Water and Sediment Discharges from Se-
Levels of the Wilcox-Carrizo and Sparta	Water Resources Data, Georgia, Water Year 1982.	lected Rivers of the Eastern United States: A
Aquifers, W85-01785 2F	W85-01938 2E	Time-Series Modeling Approach, W85-01823 2J
CEOLOGICAL CURVEY BICHARCE NO.	GEOLOGICAL SURVEY, HELENA, MT.	
GEOLOGICAL SURVEY, BISMARCK, ND. WATER RESOURCES DIV. Guide to North Dakota's Ground-Water Re-	WATER RESOURCES DIV. Statistical Analysis and Evaluation of Water-	Hydrology of Lake Padgett, Saxon Lake, and Adjacent Area, Pasco County, Florida,
sources,	Quality Data for Selected Streams in the Coal	W85-01826 7C
We5-01824 2F	Area of East-Central Montana, W85-01770 5B	Water Resources Division Training Catalog, W85-02032 9B
Water Resources Data, North Dakota, Water Year 1982,	Water Resources of the Fort Union Coal	75
W85-01936 2E	Region, East-Central Montana, W85-01772 2F	Basic Concepts of Kinematic-Wave Models, W85-02035 2A
GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.		
Ground-water Quality in the Western Snake	Streamflow Characteristics of the Yellowstone	Calibration and Verification of a Rainfall-Runoff Model and a Runoff-Quality Model for Severa
River Basin, Swan Falls to Glenns Ferry, Idaho, W85-01784 2F	River Basin, Montana, Through September 1982,	Urban Basins in the Denver Metropolitan Area Colorado,
GEOLOGICAL SURVEY, BOSTON, MA.	W85-01781 2E	W85-02044 2A
WATER RESOURCES DIV.	Potential Effects of Surface Coal Mining on the	
Water Resources Data, New Hampshire and	Hydrology of the Bloomfield Coal Tract, Dawson County, Eastern Montana.	Sediment Transport in the Lower Yampa River Northwestern Colorado,
Vermont, Water Year 1982, W85-01933 2E	W85-01791 2F	W85-02045 2.

GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H. MUENCHEN,

EOLOGICAL SURVEY, LANSING, MI.	GEOLOGICAL SURVEY, RALEIGH, NC. WATER RESOURCES DIV.	Projected Public Supply and Rural (Self-Supplied) Water Use in Florida Through Year 2020,
Estimates of Dissolved and Suspended Sub- stance Yield of Stream Basins in Michigan,	Effects of Channel Excavation on Water-Quality Characteristics of the Black River and on	W85-02036 7C
W85-01942 5A	Ground-Water Levels near Dunn, North Caroli- na,	Drainage Basins in Duval County, Florida, W85-02046 7C
EOLOGICAL SURVEY, LAWRENCE, KS. VATER RESOURCES DIV.	W85-01924 2A	
Hydrologic Responses of Stream's to Mining of the Mulberry Coal Reserves in Eastern Kansas, W85-01782 2E	GEOLOGICAL SURVEY, RESTON, VA. Benthic Phosphorus Regeneration in the Potomac River Estuary,	Magnitude and Frequency of Floods from Urban Streams in Leon County, Florida, W85-02047 4A
	W85-02088 2L	W85-02047 4A
Improvement of Flood-Frequency Estimates for Selected Small Watersheds in Eastern Kansas using a Rainfall-Runoff Model, W85-01786 2A	GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV. Highlights of the 1983 Federal-State Coopera-	Recharge and Discharge Areas of the Floridan Aquifer in the St. Johns River Water Manage- ment District and Vicinity, Florida,
Hydrologic Maps of the High Plains Aquifer,	tive Water Resources Program, W85-01829 9D	W85-02049 7C
January 1981, Southwestern Kansas, W85-01930 7C		Hydrogeology of Well-Field Areas near Tampa, Florida, Phase 2-Development and Documenta-
	Records,	tion of a Quasi-Three-Dimensional Finite-Differ-
Water Resources Data, Kansas Water Year 1982,	W85-02053 2E	ence Model for Simulation of Steady-State Ground-Water Flow,
W85-01932 2E	GEOLOGICAL SURVEY, SACRAMENTO, CA. WATER RESOURCES DIV.	W85-02052 2F
Application of Remote-Sensing Techniques to Hydrologic Studies in Selected Coal-Mined	Ground Water in the Twenty-Nine Palms Indian Reservation and Vicinity, San Bernardino	GEOLOGICAL SURVEY, TUSCALOOSA, AL. WATER RESOURCES DIV.
Areas of Southeastern Kansas, W85-01947 5B	County, California, W85-01779 2F	Water Resources Data, Alabama, Water Year
Flood-Frequency Estimates for Five Gaged	GEOLOGICAL SURVEY, SALT LAKE CITY,	1982, W85-01939 2E
Basins in Wichita, Kansas, W85-01949 2A	UT. WATER RESOURCES DIV.	CRONCE WASHINGTON INW
GEOLOGICAL SURVEY, LITTLE ROCK, AR.	Three-Dimensional Digital-Computer Model of the Principal Ground-Water Reservoir of the Sevier Desert, Utah,	GEORGE WASHINGTON UNIV., WASHINGTON, DC. INTERNATIONAL WATER RESOURCES INST.
WATER RESOURCES DIV. Water Resources Data, Arkansas, Water Year	W85-01925 7C	Estimation of Skewness of Hydrologic Varia-
1982, W85-01934 2E	GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.	bles, W85-02161 2A
GEOLOGICAL SURVEY, LOUISVILLE, KY.	Appraisal of Water from Surficial-Outwash	GEORGIA INST. OF TECH., ATLANTA.
WATER RESOURCES DIV. Water Resources Data, Kentucky, Water Year	Aquifers in Todd County and Parts of Cass and Morrison Counties, Central Minnesota, W85-02038 4B	SCHOOL OF CIVIL ENGINEERING. Formation of Stable Organic Chloramines
1982, W85-01923 2E	GEOLOGICAL SURVEY, TACOMA, WA.	During the Aqueous Chlorination of Cytosine and 5-Methylcytosine,
GEOLOGICAL SURVEY, MENLO PARK, CA.	WATER RESOURCES DIV.	W85-01726 5F
Double-Porosity Models for a Fissured Ground- water Reservoir with Fracture Skin, W85-02150 2F	Flood Elevations for the Soleduck River at Sol Duc Hot Springs, Clallam County, Washington, W85-01773 4A	Kinetics and Products of the Chlorination of Caffeine in Aqueous Solution,
	Fluoride, Nitrate, and Dissolved-Solids Concen-	W85-01727 5B
Eulerian-Lagrangian Solution of the Convec- tion-Dispersion Equation in Natural Coordi- nates,	trations in Ground Waters of Washington, W85-01828 2F	GEORGIA UNIV., ATHENS, DEPT. OF MICROBIOLOGY.
W85-02162 1B	Occurrence, Quality, and Use of Ground Water in Orcas, San Juan, Lopez, and Shaw Islands,	Relative Contributions of Bacteria and Fungi to Rates of Degradation of Lignocellulosic Detri-
GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.	San Juan County, Washington, W85-02043 7C	tus in Salt-Marsh Sediments, W85-02138 2L
Data for Ground-Water Test Hole near Nico- laus, Central Valley Aquifer Project, California,		
W85-01929 7C	GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.	GEORGIA UNIV., ATHENS, SCHOOL OF FOREST RESOURCES.
Data for Ground-Water Test Hole Near Butte City, Central Valley Aquifer Project, California,	Origins and Distribution of Saline Ground Waters in the Floridan Aquifer in Coastal South-	Forests, Floods, and Erosion: A Watershed Ex- periment in the Southeastern Piedmont,
W85-01941 7C	west Florida, W85-01778 2K	W85-01705 2J
Ground Water in the Redding Basin, Shasta and		Additional Tests on the Effect of Rainfall Inten-
Tehama Counties, California, W85-01945 4B	Municipal Solid-Waste Disposal and Ground- Water Quality in a Coastal Environment, West-	sity on Storm Flow and Peak Flow from Wild-
GEOLOGICAL SURVEY, OKLAHOMA CITY,	Central Florida, W85-01789 5E	Land Basins, W85-02166 2E
OK. WATER RESOURCES DIV. Water-Level Changes in the High Plains Re-	Distribution of Selected Chemical Constituents	Effect of Clear-Cut Silviculture on Dissolved
gional Aquifer, Northwestern Oklahoma, Prede-	in Water from the Floridan Aquifer, Southwest Florida Water Management District,	Ion Export and Water Yield in the Piedmont,
velopment to 1980, W85-01771 2F	W85-01928 7C	W85-02171 5B
Hydrology of an Abandoned Coal-Mining Area	Trends and Fluctuations in the Potentiometric	GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H. MUENCHEN,
near McCurtain, Haskell County, Oklahoma, W85-02041 5B	Surface of the Floridan Aquifer, West-Central Florida, 1961-80,	NEUHERBERG (GERMANY, F.R.). Longterm Effects of the Herbicides Atrazine
GEOLOGICAL SURVEY, PROVIDENCE, RI.	W85-01940 7C	and Dichlobenil upon the Phytoplankton Densi-
Aquifer Tests in the Stratified Drift, Chipuxet River Basin, Rhode Island,	Hydrogeology and Water Quality of Six Landfill Sites in Hillsborough County, Florida,	ty and Physico-chemical Conditions in Compart- ments of a Freshwater Pond,
W85-02039 2F		W85-01967 5C

GESELLSCHAFT FUER STRAHLEN- UND UMWELTFORSCHUNG M.B.H. MUENCHEN, NEUHERBERG (GERMANY, F.R.), INST.	HANOVER UNIV. (GERMANY, F.R.). INST. FUER WASSERWIRTSCHAFT, HYDROLOGIE UND LANDWIRTSCHAFTLICHEN	INDIANA UNIV. NORTHWEST, GARY. Availability of Dissolved Oxygen in Interstitial Waters of a Sandy Creek,
FUER OKOLOGISCHE CHEMIE.	WASSERBAU,	W85-02103 2E
Prediction of Ecotoxicological Behaviour of Chemicals: Relationship between n-Octanol/	Univariate Versus Multivariate Rainfall Statis- tics - Problems and Potentials,	INSTITUT FUER WASSERWIRTSCHAFT,
Water Partition Coefficient and Bioaccumula-	W85-01685 2B	BERLIN (GERMAN D.R.).
tion of Organic Chemicals by Alga Chlorella, W85-01959 5B	Effect of Spatial Rainfall Distribution on Sewer Flows,	Data Bank for Waterworks and Facilities - Goals and Problem-solving Concept (Datenbank
GOETTINGEN UNIV. (GERMANY, F.R.).	W85-01689 2E	Wasserwerke und Anlagen - Aufgaben und Lo- sungskonzeption).
SEDIMENTPETROGRAPHISCHES INST. Kinetic Factors of CaCO3-Precipitation and the	Real-Time Estimation and Forecasting of Spa-	W85-01969 5F
Partitioning of 12C and 13C. Studies at the Wa-	tially Distributed Areal Rainfall, W85-01700 2B	INSTITUTE FOR PESTICIDE RESEARCH,
terfalls of Guterstein and Urach (Schwabische	1100-01100	WAGENINGIN (NETHERLANDS).
Alb) (Kinetische Faktoren der CaCO3-Abschei- dung und der Fraktionierung von 12C und 13C.	HARVARD SCHOOL OF PUBLIC HEALTH,	Contribution of Leaching of Diazinon, Parath-
Untersuchungen an den Wasserfallen von Guter-	BOSTON, MA. INTERDISCIPLINARY PROGRAMS IN HEALTH.	ion, Tetrachorvinphos and Triazophos from Glasshouse Soils to Their Concentrations in
stein und Urach (Schwabische Alb)),	Comparison of the Carcinogenic Risks from Fish	Water Courses.
W85-01662 1B	vs. Groundwater Contamination by Organic	W85-01961 5B
GOLD KIST, INC., ATLANTA, GA.	Compounds, W85-02110 5C	
Effect of Low Dissolved Oxygen Concentration	W85-02110 5C	INSTITUTE FOR SOIL FERTILITY, GRONINGEN (NETHERLANDS).
on Effluent Turbidity,	HELSINKI METROPOLITAN AREA WATER	Standardization of Methods of Analysis for
W85-01653 5D	CO. (FINLAND).	Heavy Metals in Sediments,
GORE AND STORRIE LTD., TORONTO	World's Longest Tunnel, W85-02003 8A	W85-02104 5A
(ONTARIO).		
Beach Fecal Coliforms,	HELSINKI WATER DISTRICT (FINLAND).	INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
W85-01711 5B	Effects of Ammonium Effluents on Planktonic Primary Production and Decomposition in a	Modeling Algal Behaviour in the River Thames,
GORE AND STORRIE LTD., TORONTO	Coastal Brackish Water Environment. I. Interre-	W85-01720 5G
(ONTARIO), WATER RESOURCES DIV.	lations Between Abiotic and Biotic Components	
Mixing Zone Studies in the Grand River Basin,	of the Planktonic Ecosystem, W85-01840 5C	INSTITUTE OF OCEANOGRAPHIC AND
W85-01710 5B	W85-01840 5C	FISHERIES RESEARCH, ATHENS (GREECE). Mytilus galloprovincialis and Parapenaeus lon-
GROMBACH CONSULTING ENGINEERS.	HENKEL K.G.A.A., DUESSELDORF	girostris as Bioindicators of Heavy Metal and
ZURICH (SWITZERLAND).	(GERMANY, F.R.). DEPT. OF ECOLOGY.	Organochlorine Pollution,
Practical Introduction of the Remote Control	Biodegradability Testing of Poorly Water Solu- ble Compounds.	W85-01899 5A
Systems and Process Control Facilities,	W85-01957 5B	INTERNATIONAL WATER SUPPLY
W85-02006 6A		ASSOCIATION, LONDON (ENGLAND).
GUAM UNIV., AGANA. MARINE LAB.	HOKKAIDO UNIV., HAKODATE (JAPAN). FACULTY OF FISHERIES.	Leakage Control,
Terrestrial Runoff as a Cause of Outbreaks of	Behavior of Organically-Bound Iron in Seawater	W85-02016 3D
Acanthaster planci (Echinodermata: Asteroi- dea),	of Estuaries,	IOWA UNIV., IOWA CITY, INST. OF
W85-01893 5C	W85-01913 2L	HYDRAULIC RESEARCH.
	HOOGHEEMRAADSCHAP VAN RIJNLAND,	Application of the Geostatistical Approach to
GUAM UNIV., AGANA. WATER AND	LEIDEN (NETHERLANDS).	the Inverse Problem in Two-Dimensional
ENERGY RESEARCH INST. OF THE WESTERN PACIFIC.	Epilimnetic Nutrient Loading by Metalimnetic Erosion and Resultant Algal Responses in Lake	Groundwater Modeling, W85-02169 2F
Feasibility Study of Developing Valley-Fill	Waramaug, Connecticut,	W85-02169 2F
Aquifers for Village Water Supplies in Southern	W85-02093 2H	JAPAN BOTTOM SEDIMENT
Guam, W85-02026 2F	HYDRAULICS RESEARCH STATION.	MANAGEMENT ASSOCIATION, TOKYO.
2F	WALLINGFORD (ENGLAND),	Summer Peak of Nutrient Concentrations in Lake Water,
Diagenesis and Pore-Space Evolution within	Design Storm for a Tropical Location with Lim-	W85-02098 5B
Recent and Pleistocene Carbonate Units of Orote Peninsula, Guam,	ited Data, W85-01678 2B	30
W85-02027 2F	W85-010/6 2B	JAWAHARLAL NEHRU UNIV., NEW DELHI
	ILLINOIS INST. OF TECH., CHICAGO.	(INDIA). MICROBIOLOGICAL LAB. Influence of Physico-Chemical Factors on the
Comparision of Water Catchment and Storage	ARMOUR COLL, OF ENGINEERING, Metals Distributions in Activated Sludge Sys-	Coliform Bacteria in a Closed-Lake Water
Systems in Two Micronesian Atoll Communi- ties: Laura and Nama,	metals Distributions in Activated Studge Sys- tems,	System,
W85-02028 6D	W85-01737 5D	W85-01672 2H
	ILLINOIS STATE WATER SURVEY DIV.,	Distribution and Pariodisity of Total Faces
Hydrogeologic Investigation of Agana Swamp	CHAMPAIGN.	Distribution and Periodicity of Total, Faecal Coliform Bacteria in an Aquatic Ecosystem,
Northern Guam, W85-02029 2F	Potential Urban Rainfall Prediction Measure-	W85-01675 5B
	ment System, W85-01701 2B	
GUELPH UNIV. (ONTARIO). DEPT. OF	W65-01/01 2B	JOHNS HOPKINS UNIV., LAUREL, MD. APPLIED PHYSICS LAB.
LAND RESOURCE SCIENCE. Morphology and Recent Sediments of the	ILLINOIS UNIV. AT URBANA-CHAMPAIGN.	Runoff from Utility Waste Landfill to be Recy-
Lower Anastomosing Reaches of the Attawapis-	DEPT. OF CIVIL ENGINEERING.	cled from Detention Basin to Scrubber Make
kat River, James Bay, Ontario, Canada,	Mixing Effects in UV Disinfection, W85-01659 5D	Up,
W85-01734 2J		W85-01849 5D
HADASSAH MEDICAL SCHOOL,	Evaluation of Urban Design Storm Sensitivity,	KANSAS STATE UNIV., MANHATTAN, DEPT.
JERUSALEM (ISRAEL), ENVIRONMENTAL	W85-01693 2B	OF CIVIL ENGINEERING.
HEALTH LAB.	Descriptive Decision Process Model for Hierar-	Quantifying the Relative Performance of Alter
Simultaneous Concentration of Four Enterovir- uses from Tap, Waste, and Natural Waters,	The same of the sa	native Measures for Fulfilling Instream Uses in the Plains Environment,
W85-02137 5A	Systems, W85-02147 4A	

6B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF CIVIL ENGINEERING.

KANTON AARGAU, AARAU (SWITZERLAND), INFORMATIONS- UND	LUND UNIV. (SWEDEN), LIMNOLOGICAL INST.	MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF BIOLOGY.
DOKUMENTATIONS-DIENST.	Acidified Lakes: Sediment Treatment with	Dependence of Hypolimnetic Oxygen Consump-
Origin of Nitrates in Groundwater of the Bunz Valley (Woher stammen die Nitrate im Grun-	Sodium Carbonate - A Remedy, W85-02096 5G	tion on Ambient Oxygen Concentration: Fact or Artifact,
wasser des Bunztales), W85-01856 5B	LYONNAISE DES EAUX, BORDEAUX	W85-02149 2H
	(FRANCE).	MCMASTER UNIV., HAMILTON (ONTARIO),
KANTONALES AMT FUER GEWASSERSCHUTZ, SANKT GALLEN (SWITZERLAND).	Comparison of Water Mains Cleaning Tech- niques - The Experiment of Begles (Comparai- son des Techniques de Curage des Conduites	Experimental Measurement of Sediment Nitrifi- cation and Denitrification in Hamilton Harbour,
Pumps for Liquids, Especially for Wastewater (Pumpen fur Flussigkeiten, insbesondere fur Ab-	d'Eau Potable - L'Experience de Begles), W85-01999 8A	Canada, W85-02070 2H
wasser), W85-01864 8C	LYONNAISE DES EAUX, PARIS (FRANCE). Economising Water and Fighting against Wast-	MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF BIOLOGY.
KATADYN PRODUCTS, INC., WALLISELLEN	age (Economie d'Eau et Lutte contre le Gaspil-	Phytoplankton Population Dynamics of a Small
(SWITZERLAND). Ultraviolet Disinfection of Water,	lage), W85-01996 6B	Reservoir: Effect of Intermittent Mixing on Phy- toplankton Succession and the Growth of Blue-
W85-02020 5D	MARINE BIOLOGICAL ASSOCIATION OF	green Algae,
PARTIO TEPE THE ATTACON	THE UNITED KINGDOM, PLYMOUTH	W85-01916 2H
KATHOLIEKE UNIV. NIJMEGEN (NETHERLANDS). LAB. OF AQUATIC ECOLOGY.	(ENGLAND). Statistical Analysis of Estuarine Profiles: II Ap-	MCMASTER UNIV., HAMILTON (ONTARIO).
Impact of Acidification and Eutrophication on Macrophyte Communites in Soft Waters. II. Ex-	plication to Arsenic in the Tamar Estuary (S.W. England),	DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
perimental Studies, W85-01889 5C	W85-01914 5B	Evolving Data Processing Environment For Computational Hydraulics Systems,
KEAN COLL. OF NEW JERSEY, UNION.	MARYLAND UNIV., COLLEGE PARK. DEPT. OF AGRICULTURAL ENGINEERING. Blue Crab Processing Plant Effluent Treatment,	W85-01709 7C
DEPT. OF CHEMISTRY-PHYSICS. Tidal and Seasonal Variations of Sulfate Ion in a	W85-01741 5D	MELBOURNE UNIV., PARKVILLE (AUSTRALIA). MARINE CHEMISTRY LAB.
New Jersey Marsh System, W85-01848 5B	MARYLAND UNIV., COLLEGE PARK, DEPT. OF BOTANY.	Aromatic Hydrocarbons in Waters of Port Phil- lip Bay and the Yarra River Estuary,
	Effects of the Herbicide Atrazine on an Oyster-	W85-01644 5B
KORROSIONSCENTRALEN ATV, GLOSTRUP (DENMARK). Control of Metal Contaminants in Drinking	Food Organism, W85-01808 5C	METEOROLOGICAL OFFICE, POONA
Water in Denmark,	MARYLAND UNIV., COLLEGE PARK. DEPT.	(INDIA).
W85-01993 5F	OF GEOGRAPHY. State Laws Mandating Water Conservation.	Water Hyacinth Canopy and Pan Evaporation, W85-02128 4A
KREBS (PAUL B.) AND ASSOCIATES, INC.,	W85-01806 6E	MIAMILINIV CODAL CARLES EL DEPT
BIRMINGHAM, AL. Computer Modeling in Water System Planning	Recent Vertical Accretion Rates at Blackwater	MIAMI UNIV., CORAL GABLES, FL. DEPT. OF MECHANICAL ENGINEERING. Heavy Metal Migration in Soil-Leachate Sys-
and Design,	Wildlife Refuge, W85-01809 2L	tems,
W85-01906 5F	W85-01809 2L	W85-01868 5B
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.	MARYLAND UNIV., COLLEGE PARK. DEPT. OF GEOLOGY.	MIAMI UNIV., OXFORD, OH. DEPT. OF
Elemental Composition of Suspended Particles	Erosion and Sedimentation Chronology of	CHEMISTRY.
From the Yellow and Yangtze Rivers, W85-01703 2J	Three Watersheds in Maryland, W85-01835 2J	Lower Detection Limits Found for Chlorine Dioxide Contaminants,
W 65-01703		W85-01909 5F
LAUTRICH AND PECHER, DUSSELDORF (GERMANY, F.R.).	MASSACHUSETTS INST. OF TECH., CAMBRIDGE, DEPT. OF CIVIL	MICHIGAN DEPT. OF PUBLIC HEALTH,
Overflow Data of Rainwater Discharge Systems	ENGINEERING. Physically Based Flood Frequency Distribution,	LANSING.
Determined From Run Off Simulation of Plu- viograph Records,	W85-02168 2E	Ann Arbor Controls Trihalomethanes,
W85-01698 2E	MASSACHUSETTS UNIV., AMHERST. DEPT.	W85-01911 5F
LAWRENCE LIVERMORE NATIONAL LAB.,	OF CIVIL ENGINEERING.	MICHIGAN STATE UNIV., EAST LANSING.
CA. Hepatic Mixed-Function Oxidases in California	Evaluation of the Visibility Criterion of the Mas- sachusetts Sanitary Code for Swimming in Natu- ral Waters,	DEPT. OF FISHERIES AND WILDLIFE, Metal Speciation in Surface Waters of the Great
Flatfishes are Increased in Contaminated Envi-	W85-01800 6E	Lakes Region,
ronments and by Oil and PCB Ingestion, W85-01894 5A		W85-01811 5A
W63-01634	MASSACHUSETTS UNIV., AMHERST. DEPT. OF ENVIRONMENTAL SCIENCES.	MICHIGAN STATE UNIV., EAST LANSING.
LIMNOLOGISCH INST., NIEUWERSLUIS (NETHERLANDS).	Laboratory Assessment of the Toxicity of Urban Runoff on the Fathead Minnow (Pimephales	DEPT. OF RESOURCE DEVELOPMENT. Predicting Variability in a Lake Ontario Phos-
Carbon Flow Across the Sediment-Water Inter-	promelas).	phorous Model,
face in Lake Vechten, The Netherlands, W85-02066 2H	W85-02124 5C	W85-01758 2H
	MASSACHUSETTS UNIV., AMHERST. DIV.	MICHIGAN STATE UNIV., EAST LANSING.
LIVERPOOL UNIV. (ENGLAND), DEPT. OF BOTANY.	OF PUBLIC HEALTH. Lack of Nephrotoxicity in the Rat by Sodium	DEPT. OF ZOOLOGY. Influence of Acid Precipitation on Stream Inver-
Study of the Copper-Complexing Compounds Released by Some Species of Cyanobacteria,	Chlorite, a Possible Byproduct of Chlorine Di-	tebrates,
W85-01725 5B	oxide Disinfection in Drinking Water, W85-02119 5F	W85-01807 5C
LOUISIANA STATE UNIV., BATON ROUGE.	MASSEY UNIV., PALMERSTON NORTH	MICHIGAN UNIV., ANN ARBOR. DEPT. OF
INST. FOR ENVIRONMENTAL STUDIES.	(NEW ZEALAND). DEPT. OF	CIVIL ENGINEERING.
Determination of Oxidants Formed upon the Disinfection of Drinking Water with Chlorine		Use of Fixed-Bed Adsorber Models to Predict the Fluxes of Toxic Substances in Groundwaters
Dioxide,	brates in the Manawatu River,	and Soil Environments,
W85-01743 5A		

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.

MICHIGAN UNIV., ANN ARBOR, GREAT LAKES RESEARCH DIV.	MONTREAL ENGINEERING CO. LTD., ST. CATHARINES (ONTARIO).	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI.
Influence of the St. Marys River Plume on	Earth Foundation Treatment at Jebba Dam Site,	GREAT LAKES ENVIRONMENTAL
Northern Lake Huron Phytoplankton Assem-	W85-01871 8D	RESEARCH LAB.
blages, W85-01756 2H	MULTIDISCIPLINARY ENERGY AND	Satellite-Tracked Current Drifters in Lake Michigan,
MIDDLESEY BOLVIECUNIC LONDON	APPLICATIONS, SAN PEDRO, CA.	W85-01760 7B
MIDDLESEX POLYTECHNIC, LONDON (ENGLAND), URBAN STORMWATER	Characteristics of Leachates from Hazardous	NATIONAL BARK CERVICE WASHINGTON
POLLUTION RESEARCH GROUP.	Waste Landfills,	NATIONAL PARK SERVICE, WASHINGTON, DC. ECOLOGICAL SERVICES LAB.
Hydrocarbon Accumulation in Freshwater Sedi-	W85-02118 5B	Toxicity of Chlorine to a Common Vascular
ments of an Urban Catchment,	MUNICIPAL ENVIRONMENTAL RESEARCH	Aquatic Plant,
W85-02078 5B	LAB., CINCINNATI, OH. DRINKING WATER	W85-01731 5C
MILWAUKEE METROPOLITAN SEWERAGE	RESEARCH DIV.	
DISTRICT, WI. TREATMENT SERVICES DIV.	Cost and Benefits of Drinking Water Treatment,	NATIONAL SWEDISH ENVIRONMENT PROTECTION BOARD, UPPSALA (SWEDEN).
Computer Controlled Operation of an Activated	W85-01649 5F	WATER QUALITY LAB.
Sludge Plant, W85-01652 5D	MYSORE UNIV. (INDIA). DEPT. OF	Bottom Dynamics in Lakes,
***************************************	BOTANY.	W85-02054 2J
MINISTRY OF IRRIGATION, CAIRO	Trace Metal Concentrations of the Waters of a South Indian River.	
(EGYPT), RESEARCH INST. OF HIGH DAM	W85-01751 5B	Lake Trehorningen Restoration Project.
SIDE EFFECTS. Effects of Sedimentation on the Storage Capac-		Changes in Water Quality after Sediment Dredging,
ity of the High Aswan Dam Reservoir,	NAPLES UNIV. (ITALY). DEPT. OF	W85-02097 5G
W85-02101 4A	HYDRAULIC CONSTRUCTION. Two-Component Extreme Value Distribution	
MINISTRY OF WORKS AND	for Flood Frequency Analysis,	NATIONAL WATER COUNCIL, LONDON
DEVELOPMENT, CHRISTCHURCH (NEW	W85-02151 2E	(ENGLAND).
ZEALAND).	NAME OF TRANSPORT OF THE OWNER, OF	Training Programmes in Federal Systems of Government,
Groundwater Quality Survey of an Unsewered,	NAPLES UNIV, (ITALY), FACOLTA DI INGEGNERIA.	W85-01989 6F
Semi-Rural Area, W85-01633 5B	Usefulness of Measuring the Corrosion Rates of	
W85-01633	Soils (Utilite des Mesures de Corrosivitie des	NATIONAL WATER RESEARCH INST.,
Critical Depths for Passage in Braided Rivers,	Sols),	BURLINGTON (ONTARIO).
Canterbury, New Zealand,	W85-01992 8G	Temporal Distribution of Design Storm Rainfall W85-01688
W85-01636 2E	NATAL UNIV., PIETERMARITZBURG	W 63-01068 2E
MINISTRY OF WORKS AND	(SOUTH AFRICA), DEPT, OF BOTANY,	Modelling Criteria for Bubble Plumes - A Theo
DEVELOPMENT, HAMILTON (NEW	Vertical Stratification in Sediments from a Young Oligotrophic South African Impound-	retical Approach,
ZEALAND). WATER AND SOIL SCIENCE	ment: Implications in Phosphorus Cycling,	W85-01715 8E
Water Quality of the Waiohewa Stream, Ro-	W85-02086 2H	Orman Doubties in Control and Fostors Lab
torus,	MATERIAL BOARD OF WATERING AND CHARLES	Oxygen Depletion in Central and Eastern Lake Erie: Relationship with Bacteria, Chlorophyll
W85-01634 5B	NATIONAL BOARD OF WATERS, HELSINKI (FINLAND).	POC, and Morphometry,
	New Instrumentation in Automatic Water Qual-	W85-01752 2F
Nitrogen and Phosphorus in the Ngongotaha Stream,	ity Monitoring,	
W85-01635 5B	W85-02007 5G	NATIONAL WATER RESEARCH INST.,
	NATIONAL BUREAU OF STANDARDS (NEL),	BURLINGTON (ONTARIO), AQUATIC PHYSICS AND SYSTEMS DIV.
MINISTRY OF WORKS AND	BOULDER, CO. CENTER FOR CHEMICAL	Spectral Attenuation and Irradiance in the Lau
DEVELOPMENT, NAPIER (NEW ZEALAND). WATER AND SOIL DIV.	ENGINEERING.	rentian Great Lakes,
Drought Effect on High-Altitude Forests, Rua-	Vertical Temperature Distribution in Lakes, W85-01651 2H	W85-01757 2F
hine Range, North Island, New Zealand,	1105 01031	NATIONAL WATER RESEARCH INST.,
W85-01886 2A	NATIONAL CENTER FOR GROUND WATER	WINNIPEG (MANITOBA).
MINNESOTA UNIV., MINNEAPOLIS, DEPT.	RESEARCH, NORMAN, OK. Fate of Trace Organics During Rapid Infiltra-	Physical and Geochemical Characteristics of
OF CIVIL AND MINERAL ENGINEERING.	tion of Primary Wastewater at Fort Devens,	Suspended Solids, Wilton Creek, Ontario,
Three-Dimensional Streamlines in Dupuit-	Massachusetts,	W85-02056 21
Forchheimer Models, W85-02148 2F	W85-01730 5D	NATIONAL WATER SUPPLY AND
	NATIONAL ENVIRONMENTAL	DRAINAGE BOARD, COLOMBO (SRI
MINNESOTA UNIV., NAVARRE, GRAY	ENGINEERING RESEARCH INST., NAGPUR	LANKA).
FRESHWATER BIOLOGICAL INST. Methane Production in Minnesota Peatlands,	(INDIA).	Matara Water Supply Project in Sri Lanka,
W85-02135 2L	Status of Research and Development in Water	W85-02013 5
	Supply Systems in India, W85-01982 3D	NAVAL FACILITIES ENGINEERING
MONENCO CONSULTANTS LTD., CALGARY		COMMAND, CHARLESTON, SC. SOUTHERN
(ALBERTA). Distribution and Concentrations of Naturally-	NATIONAL FISHERY RESEARCH LAB., LA	DIV.
Occurring Radionuclides in Sediments in a Ura-	CROSSE, WI. Impact of an Oil Field Effluent on Microbial	Irrigation of Public Use Areas by Land Applica
nium Mining Area of Northern Saskatchewan,	Activities in a Wyoming River,	tion of Combined Industrial and Domesti Waste Effluent,
Canada,	W85-01640 5C	W85-01740 51
W85-02083 5B	NATIONAL INST. FOR WATER RESEARCH,	
MONTANA STATE UNIV., BOZEMAN, INST.	PRETORIA (SOUTH AFRICA).	NEBRASKA UNIVLINCOLN. DEPT. OF
FOR PROCESS ANALYSIS	Organization and Evaluation of Interlaboratory	AGRICULTURAL ENGINEERING.
Wastewater Treatment with Aerated Submerged	Comparison Studies among Southern African	Water Conservation through Limited Irrigation of Corn and Grain Sorghum in the Great Plain
Biological Filters, W85-01736 5D	Water Analysis Laboratories, W85-02117 5A	W85-01952
30	W85-02117 5A	
MONTPELLIER-2 UNIV. (FRANCE). LAB.	NATIONAL INST. OF OCEANOGRAPHY,	NEC ENVIRONMENTAL ENGINEERING
D'HYDROLOGIE MATHEMATIQUE, Areal Reduction Factors on Short Time and	PANAJI (INDIA). Pollution Effects Monitoring With Foraminifera	LTD., TOKYO (JAPAN). Material Balance Analysis for Fluoride Ions
Space Intervals,	as Indices in the Thana Creek, Bombay Area,	Experimental Waste Disposal Plant,
W85-01690 2B	W85-01671 5C	W85-01732 5

NEDERLANDS INST. VOOR ONDERZOEK DER ZEE, TEXEL.	NEWCASTLE AND GATESHEAD WATER CO., NEWCASTLE-UPON-TYNE (ENGLAND).	OHIO STATE UNIV., COLUMBUS, DEPT. OF CIVIL ENGINEERING.
River Elbe: Processes Affecting the Behaviour of Metals and Organochlorines During Estuarine	Micro-Electronics in the Water Industry - A Review of Present and Probable Future Devel-	Coagulation and Restabilization of Particulate, Macromolecular and Protected Organic Aqua-
Mixing, W85-01836 5B	opments, W85-02008 6A	sols by Aluminum (III), W85-02105 5F
River Weser Processes Affecting the Behaviour of Metals and Organochlorines during Estuarine Mixing,	NEWMARK (NATHAN M.) CONSULTING ENGINEERING SERVICES, URBANA, IL.	OHIO STATE UNIV., COLUMBUS, DEPT. OF ZOOLOGY.
W85-01837 5B	Nonsteady-State-Biofilm Process for Advanced Organics Removal,	Trophic Ecology of Fish Rearing Ponds,
One-Dimensional Mixing and Flushing Model of the Ems-Dollard Estuary: Calculation of Time	W85-01658 5D	W85-01833 2H
Scales at Different River Discharges, W85-01838 2L	NORCONSULT A/S, SANDVIKA (NORWAY), Drinking Water in Developing Countries - The Minimum Treatment Philosophy. A Case Study,	OLDENBURG UNIV. (GERMANY, F.R.). DEPT. OF BIOLOGY. Study of Habitat Conditions of the Macrophytic
NEVADA UNIV., LAS VEGAS, LAKE MEAD LIMNOLOGICAL RESEARCH CENTER.	W85-02018 3B	Vegetation in Selected River Systems in West- ern Lower Saxony (Federal Republic of Germa-
Limnology in Reservoirs on the Colorado River, W85-01812 2H	NORSK INST. FOR VANNFORSKNING, OSLO.	ny), W85-01887 2H
NEVADA UNIV., RENO. DEPT. OF	Norwegian Activities on Collection and Re- search on Rainfall Data,	ONTARIO MINISTRY OF NATURAL
Analysis of Pollutant Enhanced Bacterial Blue-	W85-01691 2B	RESOURCES, KENORA. NORTWESTERN REGION.
Green Algal Interrelationships Potentiating Sur- face Water Contamination by Noxious Blue- Green Algal Blooms,	NORTH CAROLINA STATE UNIV. AT RALEIGH, DEPT. OF ZOOLOGY.	Decomposition of Wild Rice (Zizania aquatica) Straw in Two Natural Lakes of Northwestern
W85-01803 5C	Traveling Screens as Sampling Gear for Vertical Distribution Studies,	Ontario,
NEVADA UNIV. SYSTEM, RENO. WATER RESOURCES CENTER.	W85-01842 7B	W85-01647 2H
LP Embedded Simulation Model for Conjunc- tive Use Management Optimization,	NORTH CAROLINA UNIV. AT CHAPEL HILL. AREA HEALTH EDUCATION	ONTARIO MINISTRY OF THE ENVIRONMENT, REXDALE. Whole-Lake Lead Burdens in Sediments of
W85-01801 4B Hydrogeochemical Investigation of Thermal	CENTERS PROGRAM. Practical Water Treatment for Communities in	Lakes in Southern Ontario, Canada, W85-02062 5B
Springs in the Black Canyon-Hoover Dam Area, Nevada and Arizona,	Developing Countries, W85-01983 5F	ORANGE COUNTY WATER DISTRICT.
W85-01804 2K	NORTH CAROLINA UNIV. AT CHARLOTTE.	FOUNTAIN VALLEY, CA. Biological Fouling of Reverse Osmosis Mem-
NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRICULTURAL ENGINEERING.	DEPT. OF MATHEMATICS, Stochastic Model for BOD and DO in Streams	branes,
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New	When the Velocity is Random and Distance- Dependent,	W85-01977 5D
Mexico, Phase II, W85-01817 3F	W85-01676 5B NORTHEASTERN FOREST EXPERIMENT	ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA). DEPT. OF BOTANY.
NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CIVIL ENGINEERING. Removal of Volatile Organic Pollutants from	STATION, DURHAM, NH. Potential for Acidification of Six Remote Ponds	Particle Size Distribution and Chemical Parameters of the Sediments of a Shallow Turbid Im-
Rapid Streams, W85-01738 5B	in the White Mountains of New Hamphire, W85-01834 5B	poundment, W85-02082 2F
NEW MEXICO UNIV., ALBUQUERQUE.	NORTHWESTERN CONNECTICUT	OREGON STATE UNIV., CORVALLIS, DEPT.
DEPT. OF MATHEMATICS AND STATISTICS. Competition Versus Optimal Control in Ground-	REGIONAL PLANNING COMMISSION, WARREN, CT. LAKE WARAMAUG TASK FORCE.	OF MICROBIOLOGY. Association of Metal Tolerance with Multiple
water Pumping when Demand is Nonlinear, W85-02141 4B	Available Phosphorus in Lake Sediments in the Netherlands,	Antibiotic Resistance of Bacteria Isolated from Drinking Water,
NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF CIVIL	W85-02092 2H	W85-02133 5F
ENGINEERING. Time Patterns of Rainfall For Estimating Design Floods on a Frequency Basis,	OFFICE OF TECHNOLOGY ASSESSMENT, WASHINGTON, DC.	OREGON STATE UNIV., CORVALLIS. SCHOOL OF FORESTRY.
W85-01687 2B	Use of Models for Water Resources Manage- ment, Planning, and Policy,	Prediction of Peak Flows for Culvert Design of Small Watersheds in Oregon,
NEW UNIV. OF ULSTER, COLERAINE (NORTHERN IRELAND), LIMNOLOGY LAB.	W85-02146 6A	W85-01820 4A
Rates of Sediment-Water Exchange of Oxygen and Sediment Bioturbation in Lough Neagh,	OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.	OTTAWA UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Northern Ireland, W85-02085 2H	Effects of Phosphate Fertilizer Applications and Chemistry-Mineralogy of the Iron Oxide System on Phosphate Adsorption-Desorption by Stream	Effect of Chlorination on Antibiotic Resistance Profiles of Sewage-Related Bacteria,
NEW YORK STATE COLL, OF AGRICULTURE AND LIFE SCIENCES,	Sediments,	W85-02139 5I
ITHACA. ECOLOGY AND SYSTEMATICS SECTION.	W85-01794 5B Mechanisms for Release of Sediment-Bound	OTTAWA UNIV. (ONTARIO). DEPT. OF GEOLOGY.
Partitioning of Phosphorus Between Particles and Water in a River Outflow,	Phosphate to Water and the Effects of Agricul-	Sedimentation in Fluvial and Lacustrine Environments,
W85-02075 2H	Particulate and Dissolved Phosphate,	W85-02057
NEW YORK STATE COLL. OF HUMAN ECOLOGY, ITHACA. DEPT. OF DESIGN AND		PADUA UNIV. (ITALY), INST. OF APPLIED MATHEMATICS.
ENVIRONMENTAL ANALYSIS, Quantitative Determination of ppb Levels of Carbamate Pesticide in Water by Capillary Gas	Mechanism of Semifluidized Bed Bioreactor for	Groundwater Response under an Electronucles Plant to a River Flood Wave Analyzed by
Chromatography, W85-01747 5A	Biological Phenol Degradation, W85-02106 5D	Nonlinear Finite Element Model, W85-02157 2

2F

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND	RIJKSDIENST VOOR DE IJSSELMEERPOLDERS, LELYSTAD	SOCIETE LYONNAISE DES EAUX ET DE L'ECLAIRAGE, PARIS (FRANCE).
AND WATER RESOURCES. Restoration of Failing On-Site Wastewater Dis-	(NETHERLANDS). Design Inflow Intensity and Design Inflow Pro-	Study Cases of Operative Conditions of Munici- pal Treatment by Lagooning (Etude des Condi-
posal Systems Using Water Conservation,	files For Storm Sewers,	tions de Fonctionnement et d'Exploitation de
W85-01656 5D	W85-01692 2E	Quelques Cas Concrets de Traitement d'Eaux Residuaires Urbaines par Lagunage),
PIRNIE (MALCOLM), INC., NEWPORT	RIJKSINSTITUUT VOOR	W85-01976 5D
NEWS, VA.	DRINKWATERVOORZIENING, LEIDSCHENDAM (NETHERLANDS).	B. 41W 4B
Pump Station Design: The Benefits of Computer Modeling,	CHEMICAL BIOLOGICAL DIV.	Potential Use of Enzymes as Catalysts in Drink- ing Water for the Oxidation of Taste Causing
W85-01905 8C	Formation and Removal of Mutagenic Activity	Substances,
PITTSBURGH UNIV., PA. DEPT. OF CIVIL	During Drinking Water Preparation, W85-01728 5F	W85-02021 5F
ENGINEERING.	BOMICON INC. WORLDN MA	SOUTH CAROLINA UNIV., COLUMBIA.
Rainfall Energy From Drop Size Data, W85-01696 2B	ROMICON, INC., WOBURN, MA. Evalution of Hollow Fiber Ultrafiltration as a Pretreatment for Reverse Osmosis Desalination	DEPT. OF GEOLOGY. 226Ra and 228Ra in the Mixing Zones of the Pec
PUBLIC WORKS DEPT. OF MALAYSIA,	of Seawater, W85-01830 3A	Dee River-Winyah Bay, Yangtze River and Delaware Bay Estuaries,
KUANTAN.	W65-01630 3A	W85-01912 2L
Microcomputer Programs for Designing Water	RUTGERS - THE STATE UNIV., NEW	SOUTH DAKOTA SCHOOL OF MINES AND
Systems, W85-01903 8A	BRUNSWICK, NJ. DEPT. OF BIOLOGICAL SCIENCES.	TECHNOLOGY, RAPID CITY, DEPT. OF
	Response of Algal Populations to Changes in	GEOLOGY AND GEOLOGICAL
PUERTO RICO UNIV., MAYAGUEZ, DEPT.	Stream Water Quality, W85-01797 5C	ENGINEERING.
OF CIVIL ENGINEERING. Seismic Design Criteria for Buried Water Pipe-	W85-01797 5C	Flood-plain Management Program in Rapid City, South Dakota,
line in Puerto Rico,	RUTGERS - THE STATE UNIV., NEW	W85-01643 2E
W85-01821 8A	BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.	SOUTHERN ILLINOIS UNIV. AT
PURDUE UNIV., LAFAYETTE, IN. DEPT. OF	Accumulation of the Trace Elements Lead and	EDWARDSVILLE, DEPT, OF CIVIL
CIVIL ENGINEERING.	Zinc by Asellus communis at Three Different	ENGINEERINGL
Depth-Duration Models of Short Time Incre-	pH Levels, W85-01795 5B	Sheetpile Interlock Tension in Cellular Coffer- dams.
ment Rainfall, W85-01683 2B		W85-01872 8A
	S-CUBED, LA JOLLA, CA. Pressure Transient Analysis for Two-Phase	
PURDUE UNIV., LAFAYETTE, IN. DEPT. OF ENVIRONMENTAL ENGINEERING.	Geothermal Wells: Some Numerical Results,	SOUTHERN WATER AUTHORITY, CHATHAM (ENGLAND), KENT DIV.
Effect of Various Hydrologic Parameters on the	W85-02163 2F	Growth of Cladophora glomerata in a River
Quality of Stormwater Runoff from a West La-	SASKATCHEWAN UNIV., SASKATOON,	Receiving Sewage Effluent,
fayette, Indiana Urban Watershed, W85-01822 5B	DEPT. OF SOIL SCIENCE.	W85-01723 5C
703-01022	Dynamics and Mechanisms of Arsenite Oxida- tion by Freshwater Lake Sediments,	SPLIT UNIV. (YUGOSLAVIA), FACULTY OF
QUEBEC UNIV., CHICOUTIMI, DEPT. DES	W85-02080 5B	ENGINEERING.
SCIENCES APPLIQUEES, Stochastic Characterization of Temporal Storm	SCRIPPS INSTITUTION OF	Rainfall as the Basis for Urban Runoff - Experi- ence and Practice in Yugoslavia,
Patterns,	OCEANOGRAPHY, LA JOLLA, CA.	W85-01682 2E
W85-01686 2B	Man-Made Structures on Marine Sediments: Ef-	SRI LANKA UNIV., PERADENIYA. DEPT. OF
Stochastic Description of Temporal Daily Rain-	fects on Adjacent Benthic Communities, W85-01895 6G	GEOLOGY.
fall Patterns,	CONTROL DES DATES CONTROLS	Geochemistry of Well Water and Cardiovascu-
W85-01712 2B	SERVICE DES EAUX, SERVICES INDUSTRIELS DE GENEVE	lar Diseases in Sri Lanka, W85-01674 50
QUEEN'S UNIV., BELFAST (NORTHERN	(SWITZERLAND),	W 05-010/4
IRELAND), DEPT. OF AGRICULTURAL AND	Planning, Implementation of Directives and	Distribution of Nitrates in the Potable Waters of
FOOD CHEMISTRY. Spatial and Temporal Trends in Heavy Metal	Pipelaying Standards, W85-01998 6B	Sri Lanka, W85-02015 5E
Concentrations in Mussels from Northern Ire-	CONTROL OF THE PARTY AND ADDRESS OF THE PARTY	
land Coastal Water, W85-01901 5A	SEVERN-TRENT WATER AUTHORITY, BIRMINGHAM (ENGLAND).	STANFORD UNIV., CA. DEPT. OF CIVIL ENGINEERING.
W83-01901 3A	Enteric Virus Levels in Wastewater Effluents	Identification of Nonionic Detergents by GC
QUEEN'S UNIV., KINGSTON (ONTARIO).	and Surface Waters in the Severn Trent Water Authority 1979-1981,	CI-MS: I. A Complementary Method or an At
DEPT. OF CIVIL ENGINEERING. Measurement of Concrete Permeability.	W85-01718 5B	tractive Alternative to GC/EI-MS and Other Methods,
W85-01714 8F	SINGAPORE METEOROLOGICAL SERVICE.	W85-01955 5A
BLODE IO AND IDAIL WINGSTON	Case Study of Heavy Rain Spell on 13th-25th	
RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.	December 1982 over the East Coast of Peninsu-	STATE CHEMICAL SUPERVISION SERVICE, SOEBORG (DENMARK).
Effects of Copper and Cadmium on Growth,	lar Malaysia and Singapore, W85-02125 2B	Determination of 4-Aminophenol in Water by
Swimming and Predator Avoidance in Euryte- mora affinis (Copepoda),		High-Performance Liquid Chromatography
W85-01900 5C	SLOVENSKA VYSOKA SKOLA TECHNICKA, BRATISLAVA (CZECHOSLOVAKIA), DEPT.	with Fluorescence Detection, W85-01746 5A
	OF SANITARY ENGINEERING.	
Microbial Metabolism in Surface Sediments and its Role in the Immobilization of Phosphorus in	Synthetic Design Storm and its Relation to In-	STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF GEOGRAPHY.
Oligotrophic Lake Sediments,	tensity-Duration Frequency Curves, W85-01679 2B	Objective Identification of Pools and Riffles
W85-02076 2J		W85-02159 2I
RIDER COLL., LAWRENCEVILLE, NJ. DEPT.	SOCIETE DEGREMONT, RUEIL- MALMAISON (FRANCE).	SUISELECTRA
OF BIOLOGY.	Potable Water Treatment in Tropical Countries:	INGENIEURUNTERNEHMUNG A.G., BASEL.
Fluxes of Heavy Metals in Delaware River Freshwater Tidal Wetlands,	Recent Experiences and Some Technological	Weinzodl Power Station on the Mur (Da Kraftwerk Weizodl an der Mur).
W85-01805 5B	Trends, W85-02022 5F	W85-01860 8/

8A

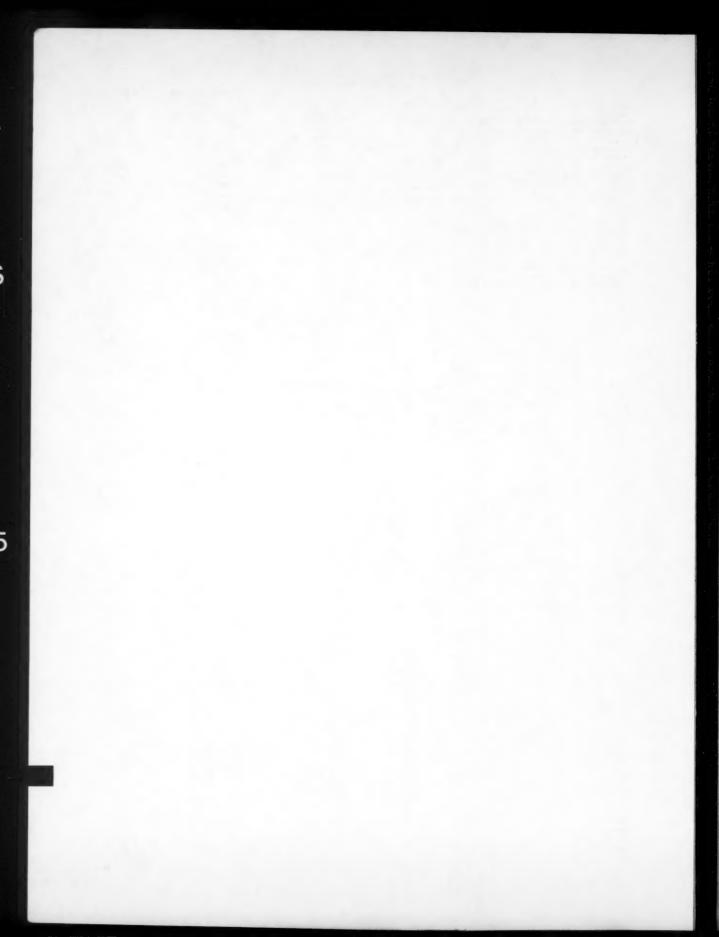
VANDEX ISOLIERMITTEL G.M.B.H., HAMBURG (GERMANY, F.R.).

SUMX CORP., AUSTIN, TX.	TECHNISCHE UNIV., DRESDEN (GERMAN	TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL
Investigation of Photocatalytic Oxidation for Wastewater Cleanup and Reuse,	D.R.). BEREICH HYDROBIOLOGIE. Ensuring a High Level of Effectiveness and Intensity of Agricultural and Water-Manage-	ENGINEERING. Flocculation Model Testing: Particle Sizes in a
W85-01813 5D	ment Production in Drinking-Water Catchment Areas (Sicherung hoher Effektivitat und Intensi-	Softening Plant, W85-01908 5F
SUNDERLAND AND SOUTH SHIELDS	tat der landwirtschaftlichen und wasserwirts-	
WATER CO. (ENGLAND). Automated Sensor Systems for Water Resource	chaftlichen Produktion in Trinkwasser-Einzugs-	TEXAS UNIV. AT DALLAS, RICHARDSON.
Pollution Warning and Treatment Process Con- trol,	gebieten), W85-01883 4D	INST. FOR ENVIRONMENTAL SCIENCES. Adsorption of Copper, Lead and Cobalt by Ac-
W85-02010 5F	Calculation of Melt-water Discharge from the	tivated Carbon, W85-01717 5D
	Snow Cover in Catchment Areas in the Mittel-	W85-01/11/
SWEDISH NATURAL SCIENCE RESEARCH	gebirge Mountains (Berechnung der Schmelz- wasserabgabe aus der Schneedecke in Einzugs-	TEXAS UNIV. AT EL PASO. DEPT. OF CIVIL
COUNCIL, STOCKHOLM. New Ecological Approach to the Water Cycle:	gebieten des Mittelgebirges),	ENGINEERING.
Ticket to the Future,	W85-01972 2C	Conventional Water Process Costs Studied,
W85-01704 6A	Forecasting of Water Level and Discharge of	W85-01706 5D
SWISS CORROSION COMMISSION,	the Elbe with the Aid of Fuzzy Modelling (Vor-	TEXAS UNIV. MEDICAL SCHOOL AT
ZURICH.	hersage von Wasserstand und Durchfluss für die	HOUSTON.
Corrosion Behaviour of Cast Iron Pipes,	hersage von Wasserstand und Durchfluss fur die Elbe mit Hilfe einer unscharfen Modellierung), W85-01973	Detection of Enteric Viruses in Treated Drink-
W85-01994 8G		ing Water,
CURACTICE DECEARCH CORD AW	Observations from the Test Operation of an Ion-	W85-02136 5F
SYRACUSE RESEARCH CORP., NY. Fate of epsilon-Caprolactam in the Aquatic En-	exchange Facility for Nitrate Removal in Drink- ing-water Treatment (Erfahrungen aus dem Er-	TOLEDO EDISON CO., OH.
vironment,	probengsbetrieb einer Ionenaustauscheranlage	Occurrence of the Asiatic Clam Corbicula flu-
W85-01956 5B	zur Nitratelimination in der Trinkwasseraufber-	minea in the Maumee River and Western Lake
CORP. COURT PEOPLE CORP. NO. 1 THE	eitung), W85-01974 5F	Erie,
SYRACUSE RESEARCH CORP., NY. LIFE AND ENVIRONMENTAL SCIENCES DIV.		W85-01753 5C
Toxicity of Organic Mixtures Saturated in Water	TECHNISCHE UNIV., HAMBURG-HARBURG	TOLEDO UNIV., OH.
to Daphnia magna. Effect of Compositional	(GERMANY, F.R.). ARBEITSBEREICH UMWELTSCHUTZTECHNIK.	Oil Spill Focuses Attention on the Problems of a
Changes,	Accumulative Phases for Heavy Metals in	Man-Made Recreational Lake,
W85-01953 5C	Limnic Sediments, W85-02077 5B	W85-01650 5B
Solubility of Organic Mixtures in Water,	W85-02077 5B	
W85-02109 5B	TECHNISCHE UNIV., MUNICH (GERMANY,	TORONTO UNIV. (ONTARIO). FACULTY OF FORESTRY.
	F.R.). INST. FUER WASSERCHEMIE UND CHEMISCHE BALNEOLOGIE.	Stomatal Control of Water Use Efficiency in
SYRACUSE UNIV., NY. DEPT. OF CIVIL ENGINEERING.	Determination of Chlorine Dioxide and Chlorite	Poplar Clones and Hybrids,
Short-Term Changes in the Base Neutralizing	in Drinking-Water (Bestimmung von Chlor-	W85-01646 2I
Capacity of an Acid Adirondack Lake, New	dioxid und Chlorit im Trinkwasser), W85-01664 5F	
York,	W 05-01007	TRENT UNIV., PETERBOROUGH (ONTARIO).
W85-01917 5B	TECHNISCHE UNIV., MUNICH (GERMANY,	Historical Changes in Anthropogenic Lead Fall-
TAMPERE UNIV. OF TECHNOLOGY	F.R.). LEHRSTUHL UND PRUEFAMT FUER WASSERGUTEWIRTSCHAFT UND	out in Southern Ontario, Canada,
(FINLAND).	GESUNDHEITSINGENIEURWESEN.	W85-02063 5B
Zinc in Water and Sediments of Two Finnish	Rainfall Events as Paths of a Stochastic Process:	TROUBLE THE TOTAL TOTAL
Lakes, W85-02065 5B	Problems of Design Storm Analysis, W85-01684 2B	TROJAN TECHNOLOGIES, INC., LONDON (ONTARIO).
11 03 02003		Ultraviolet Disinfection of Secondary Effluent,
TATA CONSULTING ENGINEERS, BOMBAY	TECHNO-CONSULT, KARACHI (PAKISTAN). Appropriate Technology to Improve Drinking	W85-01654 5D
(INDIA).	Water Quality,	
Current Water Treatment Practices in Western India - Case Studies of Two Metropolitan Cities,	W85-02014 5F	UNIVERSITY OF SOUTH FLORIDA, TAMPA. CHEMICAL AND ENVIRONMENTAL
Bombay and Ahmedabad,	TENNESSEE UNIV., KNOXVILLE, DEPT. OF	MANAGEMENT SERVICES CENTER.
W85-02024 5F	CIVIL ENGINEERING.	Dehalogenation of Three Chlorinated Hydrocar-
TECHNICAL UNIV. OF DENMARK, LYNGBY.	Sedimentation Success from Modified Jar Tests, W85-01910 5F	bons: Amine-Assisted Versus Metal-Chelate As-
DEPT. OF SANITARY ENGINEERING.	W03-01710	sisted, W85-02121 5F
Staged Approach to Application of Rainfall	TEXAS A AND M UNIV., COLLEGE	W85-02121
Data to Urban Runoff Calculations,	STATION. DEPT. OF OCEANOGRAPHY. Volatile Organic Inputs from an Ocean Outfall	Investigation of Two Possible Modes of Action
W85-01694 2E	Near Barceloneta, Puerto Rico,	of the Inert Dye Aquashade on Hydrilla,
Methods For Calculation of Annual and Ex-	W85-01963 5E	W85-02122 4A
treme Overflow Events From Combined Sewer	TEXAS SOUTHERN UNIV., HOUSTON.	UNIVERSITY OF SOUTHERN CALIFORNIA,
Systems, W85-01699 2E	DEPT. OF CHEMISTRY.	LOS ANGELES, DEPT. OF GEOLOGICAL
W 63-01099	Analysis of Aqueous Sediments for Heavy Metals,	SCIENCES.
TECHNION - ISRAEL INST. OF TECH.,	W85-01742 5B	Santa Ana River: An Example of a Sandy Braid-
HAIFA. ENVIRONMENTAL AND WATER	TEXAS TECH UNIV., LUBBOCK, DEPT. OF	ed Floodplain System Showing Sediment Source Area Imprintation and Selective Sediment Modi-
RESOURCES ENGINEERING. Contact Flocculation-Filtration of Humic Sub-	CIVIL ENGINEERING.	fication,
stances,	Fishable Waters Everywhere: An Ai-propriate	W85-01735 2J
W85-01722 5D	Goal, W85-01850 6B	WANDEN ICOLIEDMENTOL CALD II
TECHNISCHE HOGESCHOOL TWENTE,		VANDEX ISOLIERMITTEL G.M.B.H., HAMBURG (GERMANY, F.R.).
ENSCHEDE (NETHERLANDS),	TEXAS UNIV. AT ARLINGTON, DEPT. OF BIOLOGY.	Various Coating Materials for Potable Water
Dynamic Phosphate Budget Model for a Eutro-	Transport of Dissolved Organic Carbon through	Concrete Storage Reservoirs - Experiences in
phic Lake,	a Major Creek of the North Inlet Ecosystem,	Germany, Switzerland and Austria, W85-02000 8G
W85-02072 2H	W85-01766 · 2L	W 65-02000 6U

VEB PROJEKTIERUNG WASSERWIRISCHAFT,	aroki (German, D.R.).	
VEB PROJEKTIERUNG WASSERWIRTSCHAFT, ERFURT (GERMAN, D.R.).	Tort Recovery of Acid Rain Damages in the United States - Observations on Plaintiff's Prima Facie Case,	WASHINGTON STATE UNIV., PULLMAN, DEPT, OF AGRICULTURAL ECONOMICS, Breeding Mallard (Anas platyrhynchos) Habitat
Energy Studies of Wastewater-Treatment Facili- ties as a Basis for Optimal Energy Use (Ener-	W85-01667 6E	Suitability Model, W85-01792 6G
giestudien von Abwasserbehandlingsanlagen als	Acid Rain and Federal Common Law,	W83-01/92
Grundlage fur den optimalen Energieeinsatz), W85-01878 5D	W85-01668 6E International Cooperation and Acid Rain Pollu-	WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL
VEB PROJEKTIERUNG	tion: Establishing the Framework for Control,	ENGINEERING. Mechanics of Mudflows,
WASSERWIRTSCHAFT, HALLE (GERMAN D.R.).	W85-01670 6E	W85-01816 8B
Reduction of the Use of Materials with the Aid of Science and Technology at the Hydrotechno- logy and Water-Management-Planning Combine	VERMONT UNIV., BURLINGTON. DEPT. OF CIVIL AND MECHANICAL ENGINEERING. Microbial Contamination of Potable Water in	WASHINGTON STATE UNIV., PULLMAN. NUCLEAR RADIATION CENTER.
(Senkung des Produktionsverbrauchs mit Hilfe von Wissenschaft und Technik im VEB Kom- binat Wassertechnik un Projektierung Wasser-	Distribution Systems, W85-01796 5F	Organic and Inorganic Mercury Species in the Ft. Lewis Solvent Refined Coal Pilot Plant
wirtschaft),	VIAK CONSULTANTS, LINKOEPING	Water Treatment Process, W85-01798 5D
W85-01968 5D	(SWEDEN). Review of Rainfall Data Application for Design	
Intensification of Wastewater and Sludge Treat- ment Processes Through Utilization of the	and Analysis, W85-01677 2B	WASHINGTON UNIV., SEATTLE, COLL. OF FOREST RESOURCES.
Energy Potential of Wastewater (Intensivierung		Rapid BOD Measurement for Municipal Wastewater Samples using a Biofilm Electrode,
der Abwasser-und Schlammbehandlingsprozesse durch nutzung des Eigenenergiepotenitals der	Rainfall Data For the Design of Detention Basins,	W85-01739 5D
Abwasser),	W85-01695 2E	
W85-01970 5D	VIENNA UNIV. (AUSTRIA).	WASHINGTON UNIV., SEATTLE. DEPT. OF BOTANY.
VEB SYNTHESEWERKE, SCHWARZHEIDE (GERMAN, D.R.).	LIMNOLOGISCHE LEHRKANZEL. Phosphate Adsorption Kinetics of Resuspended	Phenology and Water Relations of Three Plant Life Forms in a Dry Tree-Line Meadow,
Development of the Schwarzheide Chemical Synthesis Works in the Field of Wastewater and	Sediments in a Shallow Lake, Neusiedlersee, Austria,	W85-01892 2I
By-product Treatment (Entwickling des VEB Synthesewerk Schwarzheide auf dem Gebiet der	W85-02079 2H	WASHINGTON UNIV., SEATTLE, DEPT. OF
Abwasser- und Abproduktbehandlung),	VIRGINIA INST. OF MARINE SCIENCE,	CIVIL ENGINEERING.
W85-01881 5D	GLOUCESTER POINT. Acute Toxicity of Kepone to Selected Freshwa-	Maximum Likelihood Estimates for the Param- eters of Mixture Distributions,
VEB WASSERVERSORGUNG UND ABWASSERBEHANDLING, ERFURT	ter Fishes, W85-01846 5C	W85-02156 2E
(GERMAN, D.R.). Friedrichroda Wastewater Treatment Facility -	Kepone Concentration in Juvenile Anadromous	WASHINGTON UNIV., SEATTLE. DEPT. OF MICROBIOLOGY.
Results of an Experiment (Klaranlage Friedrich- roda - Ergebnisse eines Experiments),	Fishes, W85-01847 5B	Seasonal Study of Methane Oxidation in Lake Washington,
W85-01884 5D	Effects of the Herbicide Atrazine on Adenine	W85-02134 2H
VEB WASSERVERSORGUNG UND	Nucleotide Levels in Zostera marina L. (Eel-	WASHINGTON UNIV., SEATTLE, SCHOOL
ABWASSERBEHANDLUNG, MAGDEBURG (GERMAN, D.R.) Execution of Socialist Business Management in	grass), W85-01888 5C	OF OCEANOGRAPHY. Hydrocarbons in Washington Coastal Sedi-
the Continuation of the Colbitz Movement (Die	Uptake of Kepone from Sediment Suspensions	ments,
Durchsetzing der sozialistischen Betriebswirts- chaft in Fortfuhrung der Colbitzer Bewegung),	and Subsequent Loss by the Oyster Crassostrea virginia,	W85-01915 5B
W85-01876 5F	W85-01897 5B	WATER AND SANITATION FOR HEALTH
VEB WASSERVERSORGUNG UND	VIRGINIA POLYTECHNIC INST. AND STATE	PROJECT, ARLINGTON, VA. Development and Field Testing of a Methodolo-
ABWASSERBEHANDLUNG, ROSTOCK (GERMAN, D.R.).	UNIV., BLACKSBURG. Flux-Averaged and Volume-Averaged Concen-	gy for Assessing Community Readiness for Self-Help in the Installation, Maintenance and
Construction of Rationalization Equipment at the Rostock Water-Supply and Wastewater-	trations in Continuum Approaches to Solute Transport,	Repair of Water Supply and Sanitation Facili-
treatment Facility (Rationalisierungsmittelbau	W85-02153 2F	ties, W85-01980 7C
im VEB Wasserversorgung und Abwasserbe- handlung Rostock),	VIRGINIA POLYTECHNIC INST. AND STATE	70
W85-01877 5F	UNIV., BLACKSBURG, DEPT. OF CIVIL ENGINEERING.	WATERLOO UNIV. (ONTARIO), DEPT, OF EARTH SCIENCES,
VEB ZELLSTOFF- UND PAPIERFABRIK, ROSENTHAL (GERMAN D.R.).	Effects of Urbanization on Frequencies of Over- flows and Pollutant Loadings from Storm Sewer	Contaminant Transport in Fractured Porous Media: Analytical Solution for a Two-Member
Improved Operational Control of Sedimentation Facilities Through the Use of Fiberoptic Sensors	Overflows: A Derived Distribution Approach, W85-02152 5B	Decay Chain in a Single Fracture, W85-02170 5B
(Verbesserte Betriebskontrolle von Sedimenta- tionsanlagen durch Nutzung faseroptischer Sen-	VIRGINIA STATE WATER CONTROL	WATER CORPUSING LAB DULE
soren), W85-01882 5D	BOARD, RICHMOND. DIV. OF ECOLOGICAL STUDIES.	WATERLOOPKUNDIG LAB., DELFT (NETHERLANDS).
VERMONT LAW SCHOOL, SOUTH	Annual Cycle of Kepone Residue and Lipid Content of the Estuarine Clam, Rangia cuneata,	Some Ecological Consequences of a Projected Deep Reservoir in the Kabalebo River in Surin-
ROYALTON. ENVIRONMENTAL LAW CENTER.	W85-01844 SC	ame, W85-01764 6G
Acid Precipitation and Scientific Uncertainty	VIZGAZDALKODASI TUDOMANYOS	
Problems in Probability, W85-01665 5C	KUTATO INTEZET, BUDAPEST (HUNGARY). Wastewater Purification as Related to the Study	WELSH WATER AUTHORITY, POWYS (WALES).
Economics of Acid Rain: An Invisible Hand of	of a River System (Abwasserreiningung in Ver- bindung mit der Untersuchung eines Flusssys-	Streams in the Upper Tywi Catchment in West
Control, W85-01666 5C	tems), W85-01885 5D	Wales, W85-02116 5C

ZURICH WATER SUPPLY (SWITZERLAND).

WESSEX WATER AUTHORITY, BRISTOL (ENGLAND). BRISTOL AVON DIV.	WISCONSIN UNIVMADISON. CENTER FOR LIMNOLOGY.	WYOMING WATER RESEARCH CENTER, LARAMIE,
Automated Water Laboratory - What Benefit to the Consumer, W85-02011 7B	Factors Structuring Fish Assemblages Along a Bog Lake Successional Gradient, W85-01891 2H	Evaluation of Fisherman Benefits Stemming from Special Use Fishery Management Pro- grams,
WEST VIRGINIA UNIV., MORGANTOWN, Analysis of Total Phosphorus Transport in River Systems, W85-02074 2E	WISCONSIN UNIVMADISON. DEPT. OF GEOGRAPHY. Association between Net Basin Supplies to Lake Superior and Supplies to the Lower Great	W85-01831 6B YOKOHAMA NATIONAL UNIV. (JAPAN), DEPT, OF SAFETY AND ENVIRONMENTAL ENGINEERING.
WESTERN AUSTRALIA UNIV., NEDERLANDS. DEPT. OF ZOOLOGY. Seasonal Meromixis in Three Hypersaline Lakes	Lakes, W85-01755 2H	Adsorption of Surfactants on Sediments, W85-01960 5A
on Rottnest Island, Western Australia, W85-01645 2H	WISCONSIN UNIVMADISON. WATER RESOURCES CENTER.	ZURICH WATER SUPPLY (SWITZERLAND).
WHITMAN, REQUARDT AND ASSOCIATES, BALTIMORE, MD. Pilot Plant Demonstration of Biological Phos-	Pesticides in Groundwater Beneath the Central Sand Plain of Wisconsin, W85-02025 5B	Water Supply of Alexandria Egypt, W85-01985 5F
phorus Removal, W85-01657 5D	WRIGHT STATE UNIV., DAYTON, OH.	All About Ozone - Its Advantages and Disad- vantages in Treating Water,
WINDSOR UNIV. (ONTARIO), DEPT. OF CIVIL ENGINEERING, Hydrodynamic of Circular Primary Clarifiers, W85-01716 5D	BREHM LAB. Chemical Study of the Interstitial Water Dissolved Organic Matter and Gases in Lake Erischeveland Harbor, and Hamilton Harbour Bottom Sediments—Composition and Fluxes to	W85-01986 5F Report on the Water Supply of the People's Republic of China,
WINDSOR UNIV. (ONTARIO). FACULTY OF LAW. Legal Aspects of Acidic Precipitation, W85-01669 6E	Overlying Waters, W85-01814 5B WRIGHT STATE UNIV., DAYTON, OH.	W85-01995 5F New Materials in Pipe Networks - Special Consideration of Internal Coatings,
WISCONSIN UNIVLA CROSSE, DEPT. OF BIOLOGY. Seasonal Study of a Freshwater Lake and Mi- gratory Waterfowl for Campylobacter Jejuni, W85-01639	DEPT. OF CHEMISTRY. Flux of Reduced Chemical Constituents (Fe(2+), Mn(2+), NH4(+) and CH4) and Sediment Oxygen Demand in Lake Erie, W85-02087 2H	W85-01997 2G Review of the Water Supply in the Sovie Union, W85-02012 5F

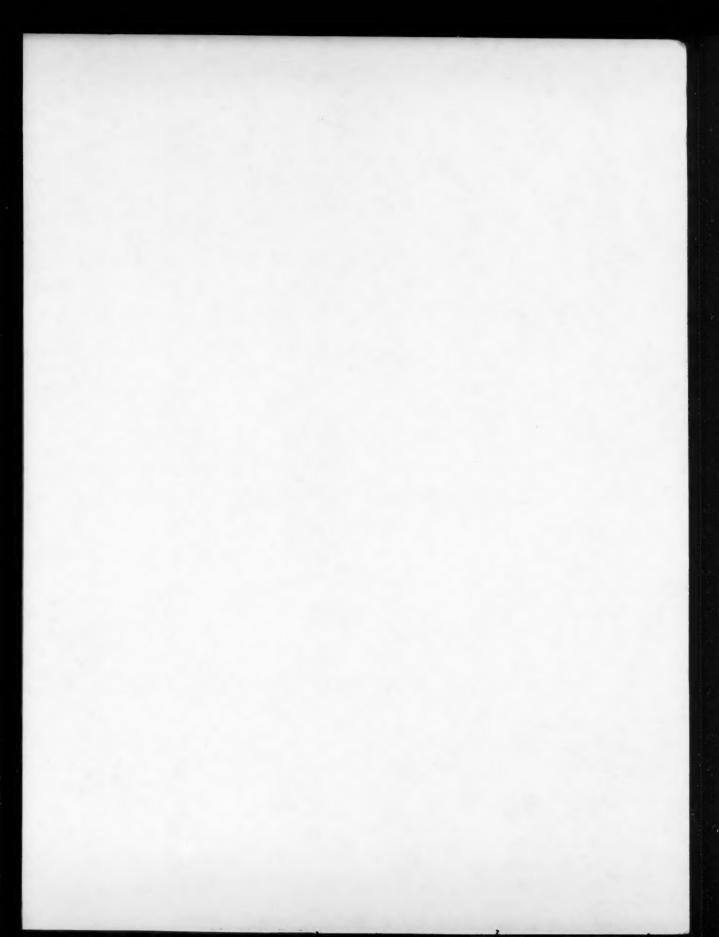


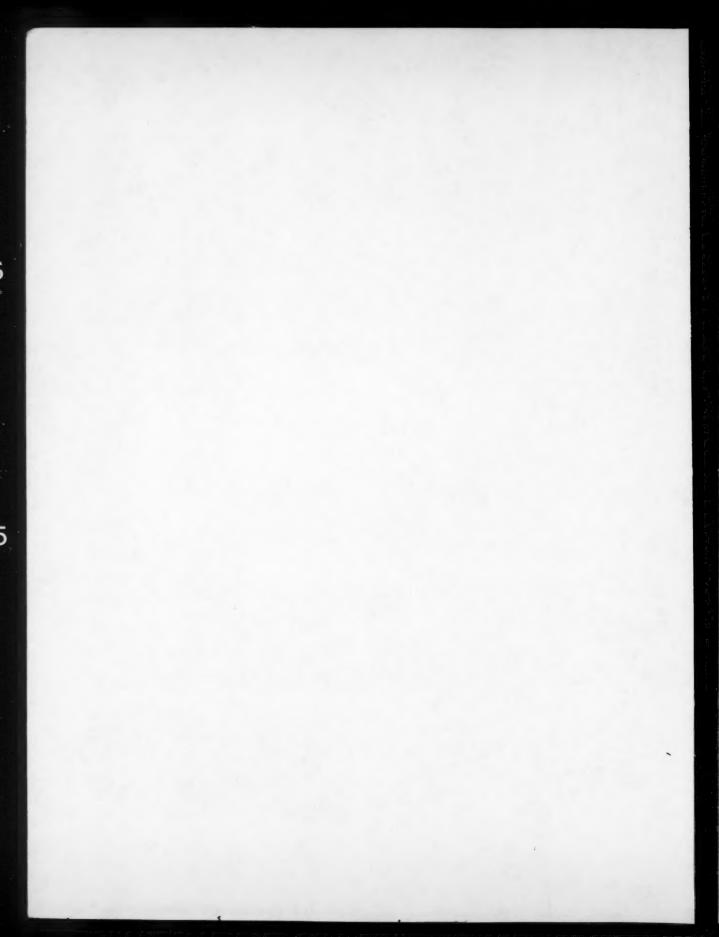
ACCESSION NUMBER INDEX

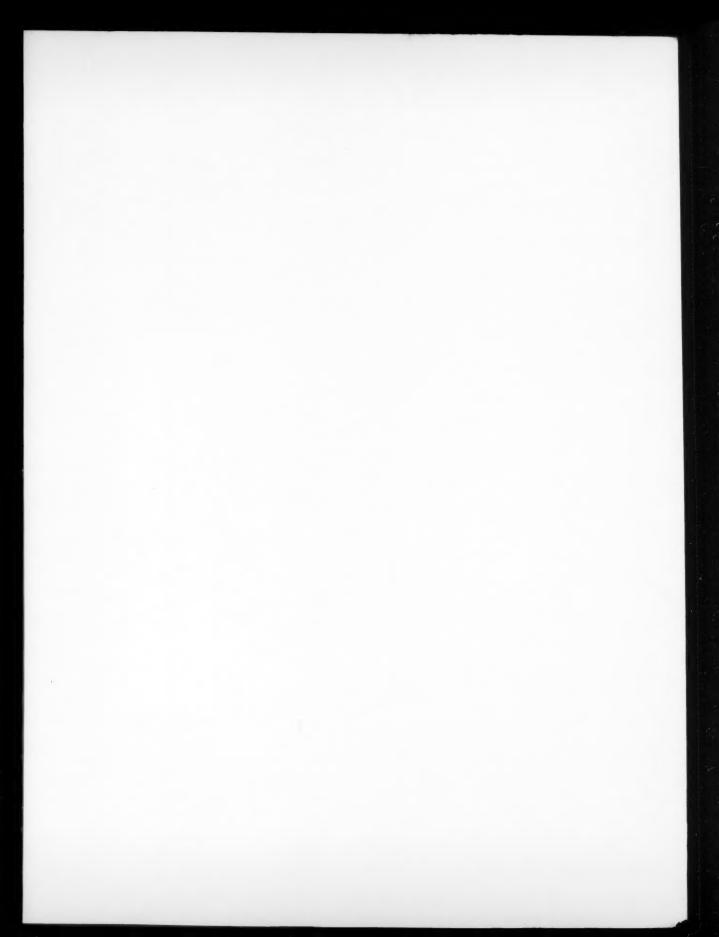
W85-01632	5C	W85-01716 5D	W85-01800 6	E	W85-01884 5	D
W85-01633	5B	W85-01717 5D		В	W85-01885 5	D
W85-01634	5B	W85-01718 5B			W85-01886 2	
W85-01635	5B	W85-01719 5D			W85-01887 2	н
W85-01636	2E	W85-01720 5G	W85-01804 2	.K	W85-01888 5	C
		W85-01721 5D		B		C
W85-01637	2H					
W85-01638	2H	W85-01722 5D			W85-01890 2	L
W85-01639	5B	W85-01723 5C	W85-01807	SC	W85-01891 2	H
		W85-01724 5D		SC		
W85-01640	5C				W85-01892 2	
W85-01641	2L	W85-01725 5B		2L	W85-01893 5	C
W85-01642	2B	W85-01726 5F	W85-01810	SC		A
W85-01643	2E	W85-01727 5B		5A		
						G
W85-01644	5B	W85-01728 5F		2H	W85-01896 5	SC
W85-01645	2H	W85-01729 5A	W85-01813	5D		5B
W85-01646	21	W85-01730 5D	W85-01814	5B		
						5C
W85-01647	2H	W85-01731 5C		SD	W85-01899 5	5A
W85-01648	2H	W85-01732 5D	W85-01816	8B		SC
W85-01649	5F	W85-01733 2F	W85-01817	3F		
W85-01650		W85-01734 2J		2F		SA
	5B				W85-01902 5	5F
W85-01651	2H	W85-01735 2J		2F	W85-01903 8	8A
W85-01652	5D	W85-01736 5D	W85-01820	4A		
	5D	W85-01737 5D		8A		5F
W85-01653					W85-01905 8	BC
W85-01654	5D	W85-01738 5B		5B	W85-01906 5	5F
W85-01655	5D	W85-01739 5D	W85-01823	2.5		
W85-01656	5D	W85-01740 5D	W85-01824	2F		5F
					W85-01908	5F
W85-01657	5D	W85-01741 5D		10C		5F
W85-01658	5D	W85-01742 5B	W85-01826	7C		
W85-01659	5D	W85-01743 5A	W85-01827	7B		5F
					W85-01911	5F
W85-01660	5D	W85-01744 5B		2F		2L
W85-01661	5A.	W85-01745 1A	W85-01829	9D		
W85-01662	1B	W85-01746 5A	W85-01830	3A	W85-01913	2L
				6B	W85-01914	5B
W85-01663	5A	W85-01747 5A				5B
W85-01664	5F	W85-01748 5A	W85-01832	3B		
W85-01665		W85-01749 5F	W85-01833	2H	W85-01916	2H
					W85-01917	5B
W85-01666		W85-01750 5B		5B		
W85-01667	6E	W85-01751 5B	W85-01835	2J		5A
W85-01668	6E	W85-01752 2H	W85-01836	5B	W85-01919	5C
			W85-01837	5B	W85-01920	6G
W85-01669		W85-01753 5C				6G
W85-01670	6E	W85-01754 5B	W85-01838	2L		
W85-01671	5C	W85-01755 2H	W85-01839	2L	W85-01922	5F
W85-01672		W85-01756 2H	W85-01840	5C	W85-01923	2E
						2A
W85-01673	2F	W85-01757 2H	W85-01841	5B		
W85-01674	5C	W85-01758 2H	W85-01842	7B	W85-01925	7C
W85-01675		W85-01759 5B	W85-01843	2L	W85-01926	7C
						2E
W85-01676		W85-01760 7B	W85-01844	5C		
W85-01677	2B	W85-01761 2H	W85-01845	5C		7C
W85-01678		W85-01762 5B	W85-01846	5C	W85-01929	7C
						7C
W85-01679		W85-01763 2H	W85-01847	5B		
W85-01680	2B	W85-01764 6G	W85-01848	5B	W85-01931	2E
W85-01681	2B	W85-01765 6G	W85-01849	5D	W85-01932	2E
			W85-01850	6B		2E
W85-01682		W85-01766 2L				
W85-01683	3 2B	W85-01767 2L	W85-01851	5D	W85-01934	2E
W85-01684	2B	W85-01768 7C	W85-01852	5D	W85-01935	2E
			W85-01853	5F	W85-01936	2E
W85-01685		W85-01769 2J				
W85-01686	5 2B	W85-01770 5B	W85-01854	5D	W85-01937	2E
W85-01687	7 2B	W85-01771 2F	W85-01855	4A	W85-01938	2E
			W85-01856	5B	W85-01939	2E
W85-01688						
W85-01689		W85-01773 4A	W85-01857	8A	W85-01940	7C
W85-01690	2B	W85-01774 2F	W85-01858	8C	W85-01941	7C
W85-01691		W85-01775 2F	W85-01859	4A	W85-01942	5A
W85-01692		W85-01776 2F	W85-01860	8A	W85-01943	4C
W85-01693	3 2B	W85-01777 2A	W85-01861	8F	W85-01944	7C
W85-01694		W85-01778 2K	W85-01862	8A	W85-01945	4B
					W85-01946	5B
W85-01695		W85-01779 2F	W85-01863	4D		
W85-01696	6 2B	W85-01780 2F	W85-01864	8C	W85-01947	5B
W85-01697		W85-01781 2E	W85-01865	5C	W85-01948	4A
					W85-01949	2A
W85-01698		W85-01782 2E	W85-01866			
W85-01699	9 2E	W85-01783 2E	W85-01867	DE .	W85-01950	
W85-01700		W85-01784 2F	W85-01868	5B	W85-01951	5B
					W85-01952	
W85-0170		W85-01785 2F	W85-01869			
W85-01702	2 2L	W85-01786 2A	W85-01870		W85-01953	
W85-01703		W85-01787 7C	W85-01871	8D	W85-01954	5A
			W85-01872		W85-01955	5A
W85-0170		W85-01788 2J				
W85-0170	5 2J	W85-01789 5E	W85-01873	5F	W85-01956	5B
W85-0170		W85-01790 7C	W85-01874	4A	W85-01957	5B
			W85-01875		W85-01958	5A
W85-0170		W85-01791 2F				
W85-0170	8 5B	W85-01792 6G	W85-01876		W85-01959	5B
W85-0170		W85-01793 5B	W85-01877	5F	W85-01960	5A
		W85-01794 5B	W85-01878		W85-01961	5B
W85-0171						
W85-0171	1 5B	W85-01795 5B	W85-01879		W85-01962	5A
W85-0171		W85-01796 5F	W85-01880	3D	W85-01963	5E
			W85-01881	5D	W85-01964	2K
W85-0171		W85-01797 5C				
W85-0171	4 8F	W85-01798 5D	W85-01882	5D	W85-01965	2K
W85-0171		W85-01799 4C	W85-01883	4D	W85-01966	5C
35-01/1						

W85-01967

W85-01968 W85-01969 W85-01970 W85-01971	5C 5D 5F	W85-02019 W85-02020	5F 5D	W85-02071	2J		W85-02123	7B
W85-01968 W85-01969 W85-01970 W85-01971	5D		4D		OTT			
W85-01969 W85-01970 W85-01971			2D	W85-02072	2H		W85-02124	5C
W85-01970 W85-01971		W85-02021	5F	W85-02073	2H		W85-02125	2B
W85-01971	5D	W85-02022	5F	W85-02074	2E		W85-02126	21
	5D	W85-02023	5D	W85-02075	2H		W85-02127	2I
W85-01972	2C	W85-02024	5F	W85-02076	2J		W85-02128	4A
	2E	W85-02025	5B	W85-02077	5B		W85-02129	5B
	5F	W85-02026	2F	W85-02078	5B		W85-02130	6A
	5D	W85-02027	2F	W85-02079	2H		W85-02131	5F
	5D	W85-02028	6D	W85-02080	5B		W85-02131	5B
W85-01977	5D	W85-02029	2F	W85-02081	2H		W85-02132	5F
W85-01978	5D	W85-02030	7B	W85-02082	2H			2H
W85-01979	5G	W85-02031	7C	W85-02083	5B		W85-02134	
W85-01980	7C	W85-02032	9B	W85-02084	2H		W85-02135	2L
W85-01981	5F	W85-02033	10C	W85-02085	2H		W85-02136	5F
	3D	W85-02034	7C	W85-02086	2H		W85-02137	5A
W85-01983	5F	W85-02035	2A	W85-02087	2H		W85-02138	2L
W85-01984	6B	W85-02036	7C	W85-02088	2L		W85-02139	5D
W85-01985	5F	W85-02037	2E	W85-02089	2E		W85-02140	5F
W85-01986	5F	W85-02038	4B	W85-02090	2K		W85-02141	4B
W85-01987	5F	W85-02039	2F	W85-02091	5B		W85-02142	3F
W85-01988	5F	W85-02040	5B	W85-02092	2H		W85-02143	3F
W85-01989	6F	W85-02041	5B	W85-02093	2H		W85-02144	6A
W85-01990	5G	W85-02042	2H	W85-02094	2F		W85-02145	6F
W85-01991	8A	W85-02043	7C	W85-02095	5B		W85-02146	6A
W85-01992	8G	W85-02044	2A	W85-02096	5G		W85-02147	4A
W85-01993	5F	W85-02045	2J	W85-02097	5G		W85-02148	2F
W85-01994	8G	W85-02046	7C	W85-02098	5B	_		2H
W85-01995	5F	W85-02047	4A	W85-02099	2H	6	W85-02149	
W85-01996	6B	W85-02048	2E	W85-02100	2.3		W85-02150	2F
W85-01997	2G	W85-02049	7C	W85-02101	4A		W85-02151	2E
W85-01998	6B	W85-02050	7C	W85-02102	2H		W85-02152	5B
W85-01999	8A	W85-02051	2E	W85-02103	2E		W85-02153	2F
W85-02000	8G	W85-02052	2F	W85-02104	5A		W85-02154	2F
W85-02001	5F	W85-02053	2E	W85-02105	5F		W85-02155	3F
W85-02002	6D	W85-02054	2.3	W85-02106	5D		W85-02156	2E
W85-02003	8A.	W85-02055	23	W85-02107	6B		W85-02157	2F
W85-02004	5F	W85-02056	2H	W85-02108	5B		W85-02158	2A
W85-02005	5F	W85-02057	2J	W85-02109	5B		W85-02159	2E
W85-02006	6A	W85-02058	2J	W85-02110	5C		W85-02160	
W85-02007	5G	W85-02059	2H	W85-02111	21		W85-02161	2A
W85-02008	6A	W85-02060	6G	W85-02112	4C		W85-02162	
W85-02009	6A	W85-02061	2K	W85-02113	5A		W85-02162	2F
W85-02010	5F	W85-02062	5B	W85-02114	5A			
W85-02011	7B	W85-02063	5B	W85-02115	5A.		W85-02164	
W85-02012	5F	W85-02064	2J	W85-02116	5C		W85-02165	
W85-02013	5F	W85-02065	5B	W85-02117	5A		W85-02166	
W85-02014	5F	W85-02066	2H	W85-02118	5B		W85-02167	
W85-02015	5B	W85-02067	2H	W85-02119	5F		W85-02168	
W85-02016	3D	W85-02068	5B	W85-02120	5B		W85-02169	
W85-02017	6A	W85-02069	2E	W85-02121	5F		W85-02170	5B
W85-02018	3B	W85-02070	2H	W85-02122	4A		W85-02171	5B







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INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

WATER CYCLE

WATER SUPPLY AUGMENTATION AND CONSERVATION

WATER QUANTITY MANAGEMENT

WATER QUALITY MANAGEMENT

WATER RESOURCES PLANNING

RESOURCES DATA

ENGINEERING WORKS

SCIENTIFIC AND TECHNICAL

